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CONTEST RULES

1. Contest open to all amateur model builders. Employees of Testor Chemical Co. are not eligible.
2. Cash prizes will be awarded as follows: first prize—$1,000; second prize—$500; third prize—$250; fourth prize—$100; 115 prizes of $10 each. In case of ties, duplicate prizes will be awarded.
3. Prizes will be awarded for those entries made from Testor's B-29 solid scale model kit which, in the opinion of the judges, show finest craftsmanship in finishing.
4. Each entry in this contest must have been made personally by the model builder in whose name it is entered. Contestants may enter as many models as they desire, but no contestant shall be eligible for more than one prize.
5. All entries must be forwarded to Testor Chemical Company, Prize Contest Department, 500 Buckbee Street, Rockford, Illinois . . . carefully packed, and tagged with sender's name and address.
6. Contest opens March 15, 1946 and closes May 15, 1946. Entries must bear a postmark not later than 6 p.m. of May 15, 1946, or must have been shipped not later than that time. Winners will be announced as soon as practicable after closing date.
7. Prize-winning entries will become the property of Testor Chemical Company. Every effort will be made to return non-winning entries by express collect, but Testor Chemical Company assumes no responsibility therefor.
8. Contest judges will be: Jay P. Cleveland, *Model Airplane News;* Charles A. Penn, *Model Craftsman;* William Winter, *Air Trails.* Decision of the judges will be final.

Biggest news in the model field! Think of it . . . $3,000.00 in cash prizes for the best-finished models of Testor's B-29 Super-Fortress! First prize — $1,000.00; second p $500.00; third prize — $250.00; fourth prize — $100.00; a 115 prizes of $10.00 each! *You* can be one of the winners, w kit from your dealer and go to work today. You will find contest doubly interesting because it will introduce you to T sensational new finishing materials . . . sanding sealer, pigm dopes, gloss top-coat. A Manual of Finishing Instructions cluded in each kit) will give you complete details; will show how easy it is to apply a finer, smoother, more brilliant finish ever before to your solid, flying, and scale model planes. for this exciting contest are shown at the left. Read them fully . . . then start your entry as soon as possible. Good l

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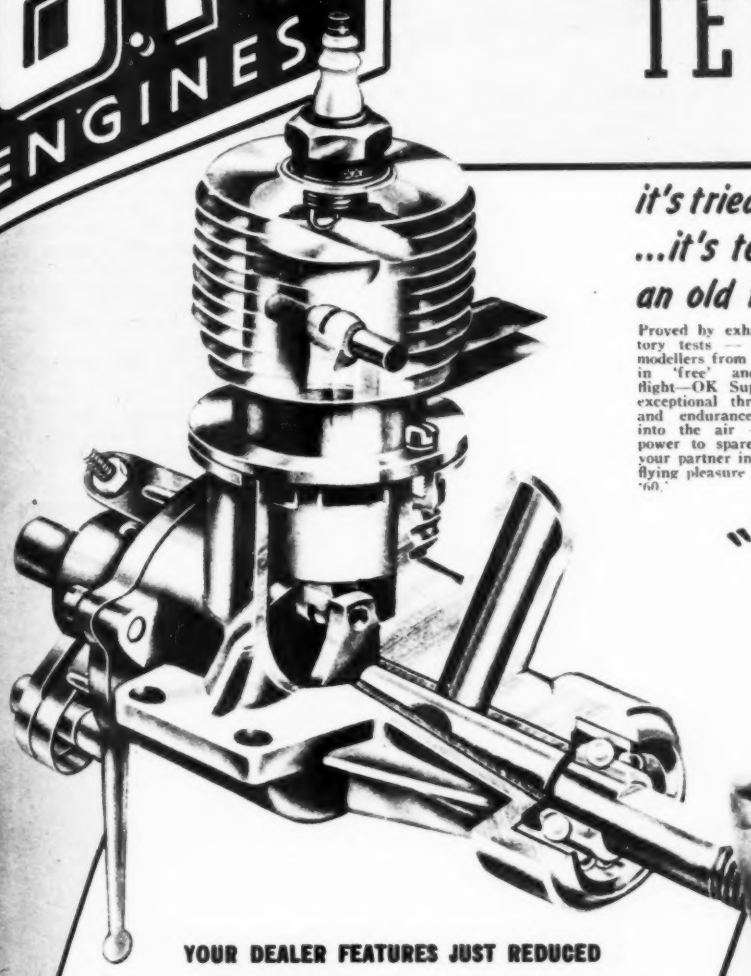
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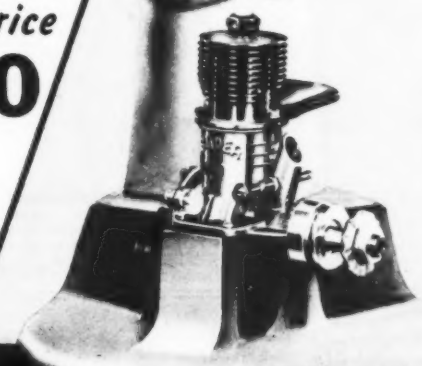
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OK "A Snap to Start"

MODEL AIRPLANE NEWS

GEORGE C. JOHNSON, Publisher — JAY P. CLEVELAND, General Manager

APRIL, 1946 — Vol. XXXIV No. 4

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AN AIR AGE PUBLICATION

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Flash

THE HUGHES *Hercules* is back in the news again in four year old "on-again, off-again" battle for its completion. Latest off-again report originates from resignation of Charles W. Perelle, $75,000 year production man who took with him his own staff of topnotch trouble shooters. After sinking $18,000,000 into the project, the Reconstruction Finance Corp. was ready to put up another $1,500,000 for moving the monster from its Culver City plant to its San Pedro launching site, when Howard Hughes balked. Reason: RFC insists on naming its own test pilot; Hughes wants to fly it himself. This, and numerous other differences, brought on Perelle's resignation and another crisis. Whether the monster (212 tons gross weight as compared to 130 tons of the giant Consolidated XB-36 bomber) will fly this year or ever is a moot question. One thing certain is its removal from Culver City plant, which RFC has placed up for sale and for which offers have already been submitted.

THE FIRST TWO privately owned jet propelled aircraft have been delivered to their new owners. Two Bell P-59A *Aircomets* were sold, one each to Hancock School of Aeronautics of the University of Southern California and Purdue University. Price: $150 each plus ferrying costs. There is only one stipulation: they cannot be flown!

TRUE extent of the Japanese balloon barrage against the U.S. was revealed with the news that 9000 of these fiendish devices were launched before the supply of them ran out in March 1945. The al-

(Turn to page 58)



(Above) Powerful Consolidated Vultee XP-81 fighter carries GE propjet unit in nose and GE type I-40 normal jet in tail; either or both can be use to drive the 50 ft. span ship which has a top speed well over 500 mph. (Below) Navy fighter McDonnell FD-1 *Phantom* weighs less than 10,000 lbs. fully loaded, is powered by two Westinghouse axial flow jet engines in wing roots



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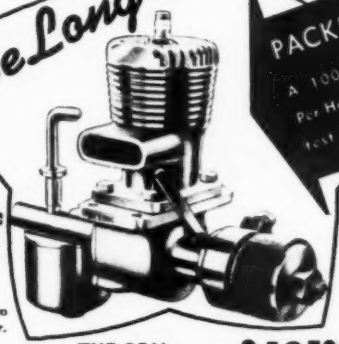


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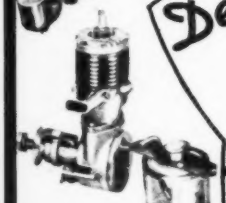
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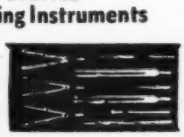
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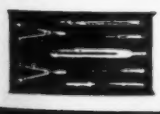
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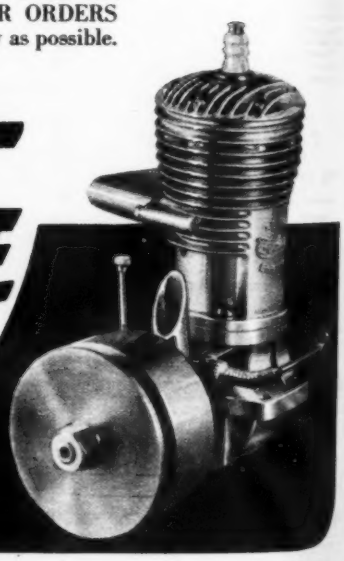
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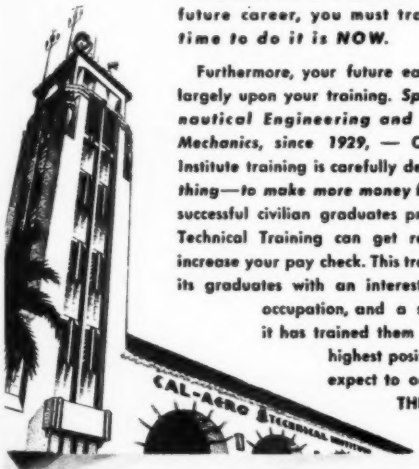


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(This report is on sale at the Government Printing Office)

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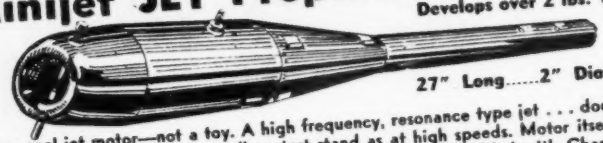
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8" & 9" 55c	10" & 11" 60c
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NEWSLETTER

by AL LEWIS

NOW THAT THE manufacturers are swinging into production and more engines are becoming available, it behooves us to think of out-of-sight flights. We especially refer to that sinking feeling in the pit of your stomach when you see your favorite engine disappearing into the blue along with a growing suspicion that it's a goner.

What we would like to recommend is a little psychological warfare with the individual who may pick up your plane and debate on whether to notify you or stash it away behind his kitchen door. License numbers on the wing are what we have in mind; you'd be surprised how official they look to the uninitiated and how many models have been returned because of them.

In the past the idea has been to put license numbers only on the wings of gas jobs; now we're advocating that you slap your AMA license number over all your jobs: gas, free flight or control; rubber; towline gliders; and anything else you may have including jet or atomic.

Look at it the way the finder does—here's one model with a big, black license number on it along with the owner's name and address and the identification certificate saying it is licensed by the Academy of Model Aeronautics. A second model has none of this. Which do you think he is apt to return? Right! The job with the official-like appearance.

So take a tip and get your model back. Past performances have shown that you stand a better chance of recovering out-of-sighters if you've applied your license numbers. And never, never fly without your name and address on the model.

* * *

BY THE WAY—this is the 12th year for the Academy of Model Aeronautics. The "old" AMA is acquiring a beard. Know what its goal is for '46?—100,000 licensed modelers! Here's wishing it the best of success.

* * *

RAN INTO A CHAP the other day we'd like you to know. He's ex-Lt. Joe Kosby, until recently in charge of Navy gun crews aboard tankers and cargo vessels. Fifteen years an aeromodeler, and an avid gas fan, Joe found that control liners were just the job for building at sea during off-watch periods. He figgers he's built about a dozen of the buzz buggies while wallowing through the Pacific with high octane gas or bombs aboard. Contends it's a good way to get your mind off your surroundings. Could be. His system was to build the planes while at sea, then hitch up an engine whenever he hit his home port of Palo Alto (or for that matter, any place in California).

Altho he was too much on the go to fly regularly in contests, Joe is an honorary member of the Palo Alto U-Control Club and is looking forward to bigger and better things in the way of contest flying and design advancements. Speaking of design advancements, his latest job is the *Super Snipe* (named he claims after the youngest Kosby). Appears to be a rip snorter—the plane not the offspring—and we're waiting with bated breath to hear of its performance.

* * *

GATHER 'ROUND all ye married modelers, we have a suggestion of note.

(*Turn to page* 54)

THERE'S *No Foolin'*

Rocket ENGINES

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Lockheed "HUDSON"
00" MFM Kit SF-95 $7.50



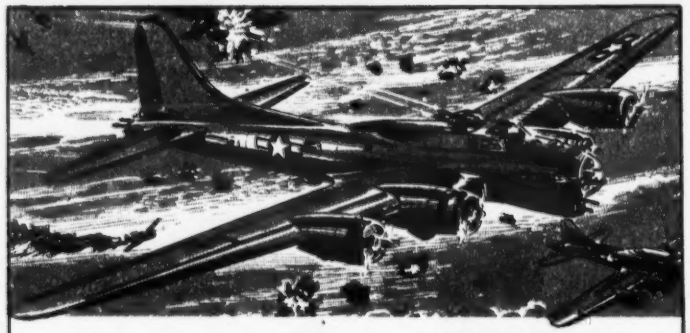
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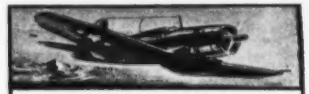
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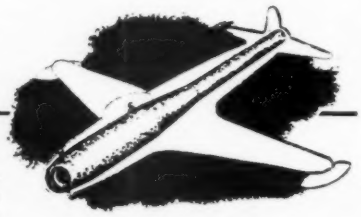
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A NEWSPAPER reporter who turned columnist just before the war once told me just how he started writing his column. He said he knew so many different people in such widely scattered cities and towns that he was absolutely unable to keep up his "talking acquaintance" much less his correspondence, so he started his column as a means of saying "hello" to everyone.

Well, to be frank, we know quite a few people in quite a few places and with a little pushing we could probably say "hello" very handily. But look how easy it is this way. Anyway fellows, particularly you unsung heroes on the West Coast, write in and say hello, and we'll try to help you with tips on new articles coming out and also the latest dope on contests.

Incidentally, speaking of contests, the Lockheed Club of Burbank and Glendale



Twin Phantom P-30's power this scale 8-24, a beautiful performer, shown with its builder Phil Babcock (center) and two members of Snafu Club

model builders sponsored by L.E.R.C. at Lockheed is now making plans for their semi-annual U-Control meet to be held about the middle of March. Rex Bloom, Contest Director, and President Gerald Barden are exhorting club members to make this event the largest ever put on by the Lockheed Club. A total of 17 trophies and merchandise from dealers around town have stirred up quite a bit of interest among the Los Angeles U-Control flyers.

Interesting to note is one particular event which really warms our heart: the scale flying contest. In the Santa Ana Air Base contest last year we originated this event for the benefit of those boys who liked to build airplanes that looked and flew like the real thing.

(*Turn to page* 44)

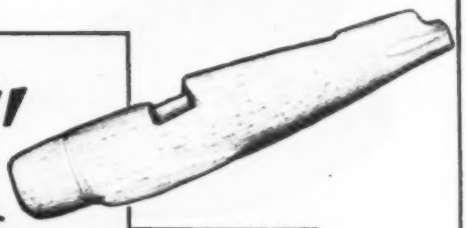
John Shields Jr. with his Bunch powered Great Lakes Trainer which gained 2nd place at Santa Ana Air Base Contest



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KING FISHER

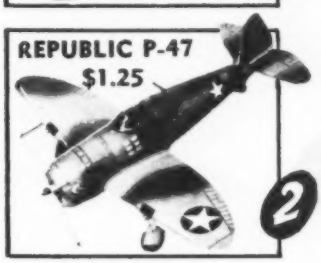


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1

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PACER 'C' $4.95



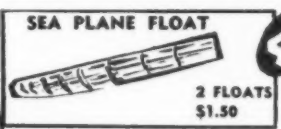
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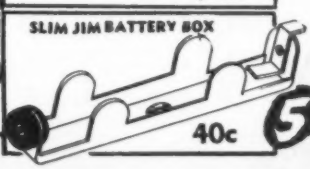


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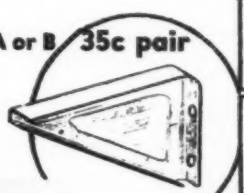
SLIM JIM BATTERY BOX



40c

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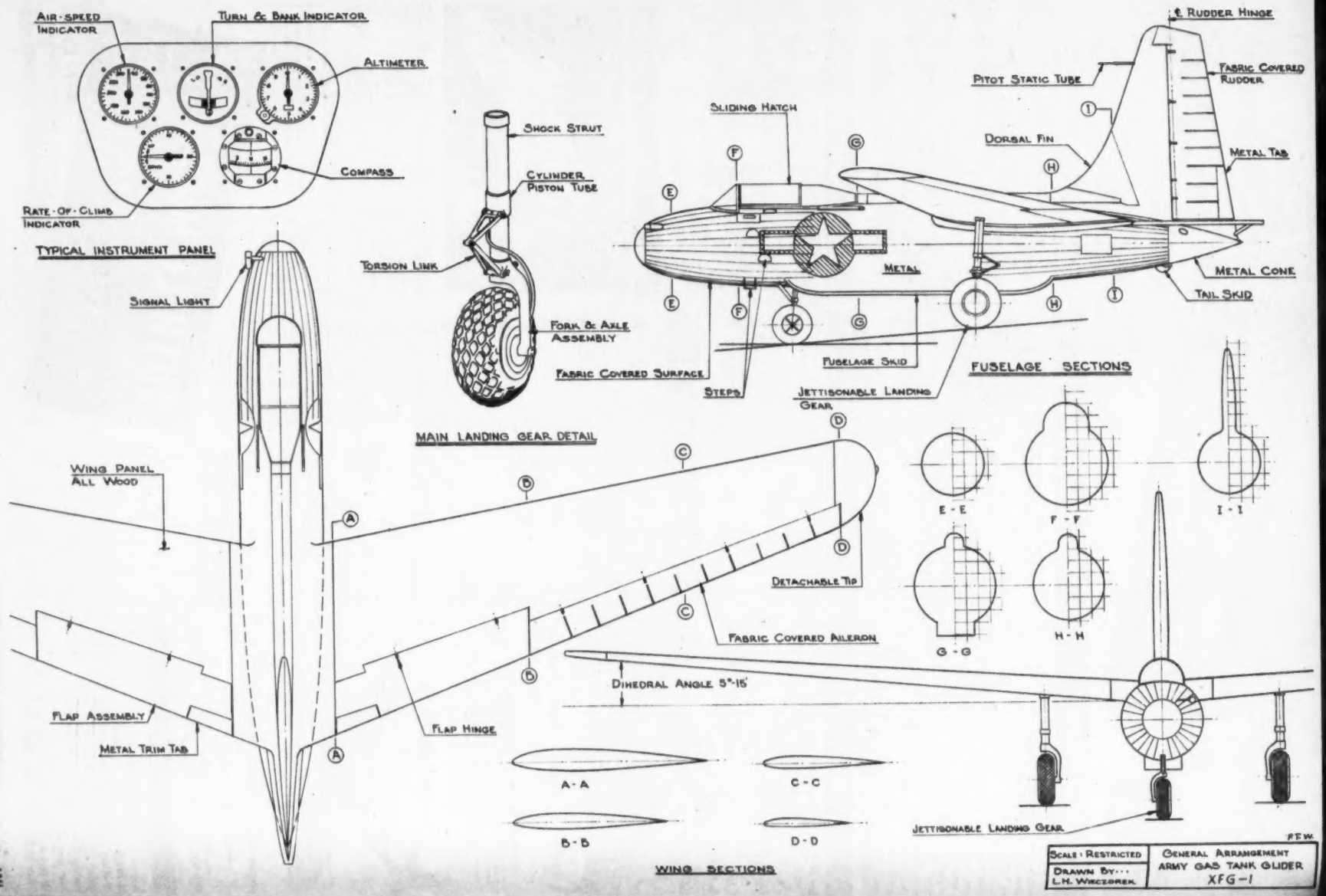
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METAL TAB
METAL
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TAIL SKID
FABRIC COVERED SURFACE
STEPS
FUSELAGE SKID
JETTISONABLE LANDING GEAR
FUSELAGE SECTIONS
E-E
F-F
I-I
G-G
H-H
DETACHABLE TIP
FABRIC COVERED AILERON
DIHEDRAL ANGLE 5°-15'
A-A
C-C
B-B
D-D
WING SECTIONS
JETTISONABLE LANDING GEAR
F.E.W.
SCALE: RESTRICTED
DRAWN BY... L.H. WIECZOREK
GENERAL ARRANGEMENT
ARMY GAS TANK GLIDER
XFG-1

xfg-1

by ROBERT McLARREN

This radical development may make record non-stop flights possible

THE technological battle between Allied and enemy scientists, carried on thousands of miles from each other, was as deadly and important as the hand-to-hand combat of the infantry on the front lines. This scientific battle was, in its own way, as difficult and as unpredictable as the wing-to-wing sky battles over Germany.

When we were struck at Pearl Harbor we started our engineering battle with the German and Japanese scientists. It was obvious that we needed to do two things to produce overwhelming Air Power: (1) produce unheard of quantities of bombers, fighters and cargo planes; and (2) develop new designs with superior performance and hitting power.

This we set out to do. But one salient fact quickly emerged: we could obtain huge quantity production much more rapidly than we could obtain new designs. Every effort was thrown into the two-pronged problem of production and creation, one the antithesis of the other.

The first year of war proved one significant fact: the creation and development of new, experimental models is a costly, time-taking procedure. To fly the first experimental model of a new fighter plane required 18 months. A new medium bomber took more than two years to bring past the flight test stage. A super-bomber required more than three years of hard, intensive research and development to place on the production line. And there was no time!

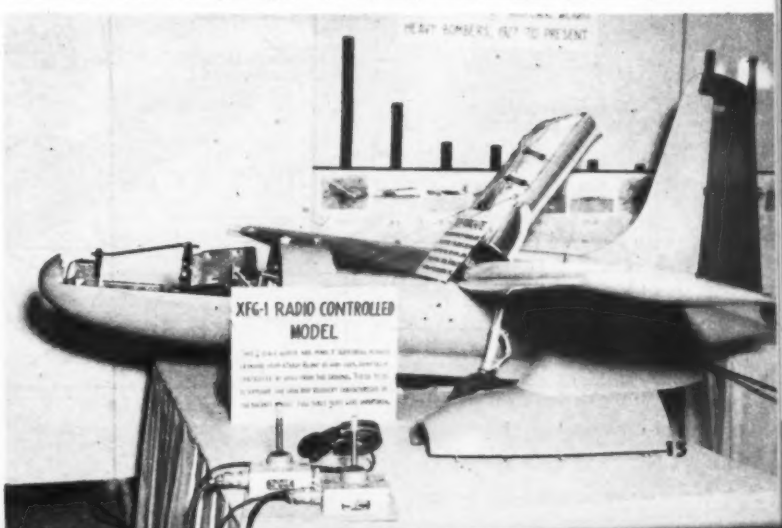
Only one alternative remained: improve existing models in quantity production. This tremendous, exciting story of the improvement of successive models has been told and will continue to be told in *Plane on the Cover*. Armament, speed, maneuverability—the list of qualities doubled and sometimes trebled in existing types is endless. This month we want to talk about range, the ability of an airplane to fly a long way to the enemy, hit him with a sufficiently deadly load to do effective damage and then return to the takeoff point.

Military aircraft are grossly inefficient aircraft. And they can afford to be inefficient in achieving speed, climb, maneuverability, quick takeoff time and many other characteristics. But long range, in any kind of airplane, is basically a problem of efficiency. On this one point nothing, regardless of its seeming insignifi-

(*Turn to page* 93)

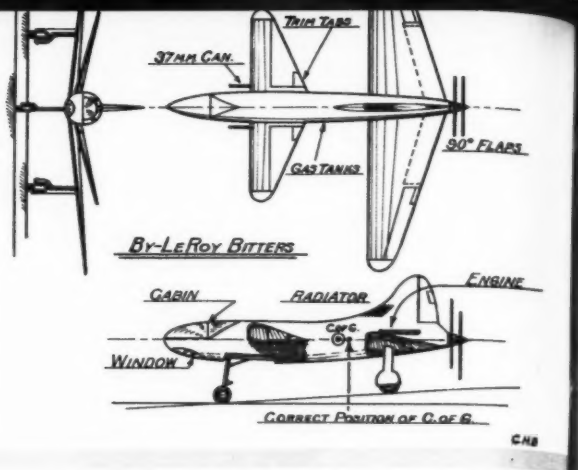


(Above) Two views of the prototype XFG-1. (Below) Radio controlled ¼ scale flying test model



by CHARLES H. GRANT

design forum



A canard fighter which shows good knowledge of design principles

FOR the last twenty years there has been only slight change in the basic design of airplanes. Most of the change has occurred in the way airplanes have been built, not designed. Where there were changes in design, they were refinements or complications, sometimes called improvements.

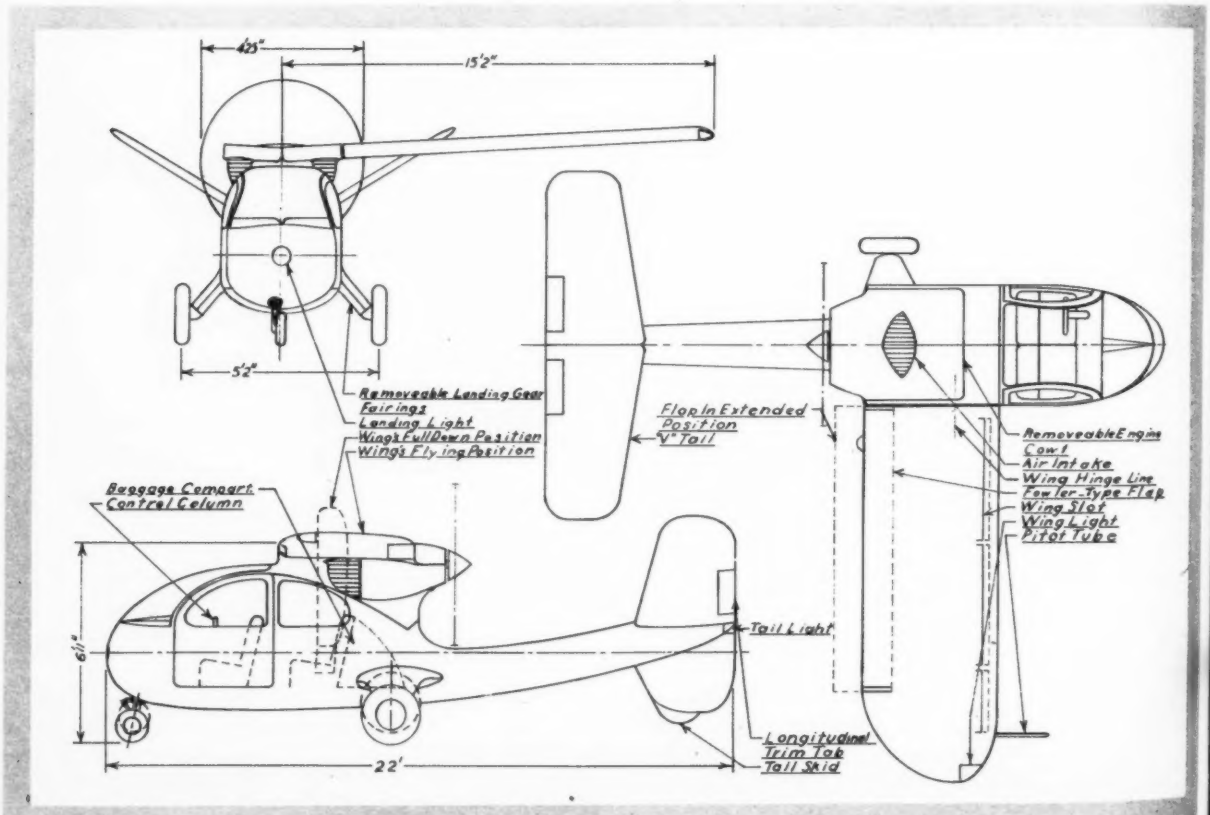
The standard practice, as far back as twenty years ago and up to about 1943 was to build airplanes along tractor lines. The monoplane prevailed with tail surfaces in the rear and engines in the nose or on the wings when multi-engine. This arrangement seemed to be most efficient. Apparently it was a case of having found gold, there was no use of looking any further. This philosophy resulted in improving and developing to the fullest extent the type under consideration, but discouraged the research in, and the development of, airplanes based upon any other design formula. It was felt useless to search for better airplanes of other basic types when the standard tractor models were so efficient. This was due not only to mental inertia but to the great expense required to develop new types from scratch. However, what man refused to do himself was brought about by the natural course of events.

Demands of high speed for combat airplanes stimulated research and shook designers loose from their old trends of thought. This resulted in production of the jet motor. Having once been thrown from the old rut of design, consideration was given to other types of planes that might be more adaptable to this form of power plant. A jet motor requires a rearward opening for expulsion of gases at high velocity. Obviously no part of the airplane can be located in or even near this high speed gas jet. Consequently it is required that the jet opening be well below the tail surfaces—or what is even better, to the rear of all parts of the airplane.

Because of this, designers gave Canard type airplanes careful consideration.

(*Turn to page* 38)

This two place lightplane has several unusual features including a pivoted wing and V tail



by PVT. BRUCE WENNERSTROM

miss bobby sox



This high performance rubber job really looks like an airplane

MISS BOBBY SOX was evolved from the *Skylark* (Dec. '44 M.A.N.) and is the fifth variation on the *'Lark* theme.

Built out of practically nothing, the *'Lark* was the first model constructed by the author after being "selected" to serve his "uncle" (Samuel, know him?) during the summer of '44. We bitterly packed mags, manuals and models away, dunked our engines in a can of S.A.E. 70 motor oil and left to answer our country's calling. (We ran into trouble right off, though, when balsa chips were found in our foot locker during first inspection.) Also, non-modelin' G.I.'s hate the smell of dope (ever try carrying a model in a barracks bag when you're being transferred?).

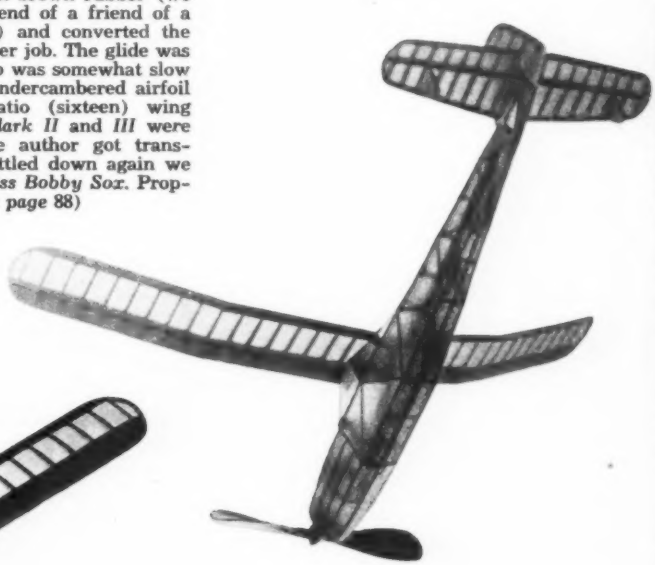
Such a forced curtailment of our modeling activities was not without its good points, however. No longer was a model designed in the morning, built in the afternoon, covered that night, and flown the next day. With few opportunities for actual building, we spent more time on the design. Free flight gas was out, for the spans were too large, and with no rubber we turned to towline gliders.

The *'Lark* was finished just in time to lose itself in one of the last thermals of the summer, carrying our Hillcrest dethermalizer with it.

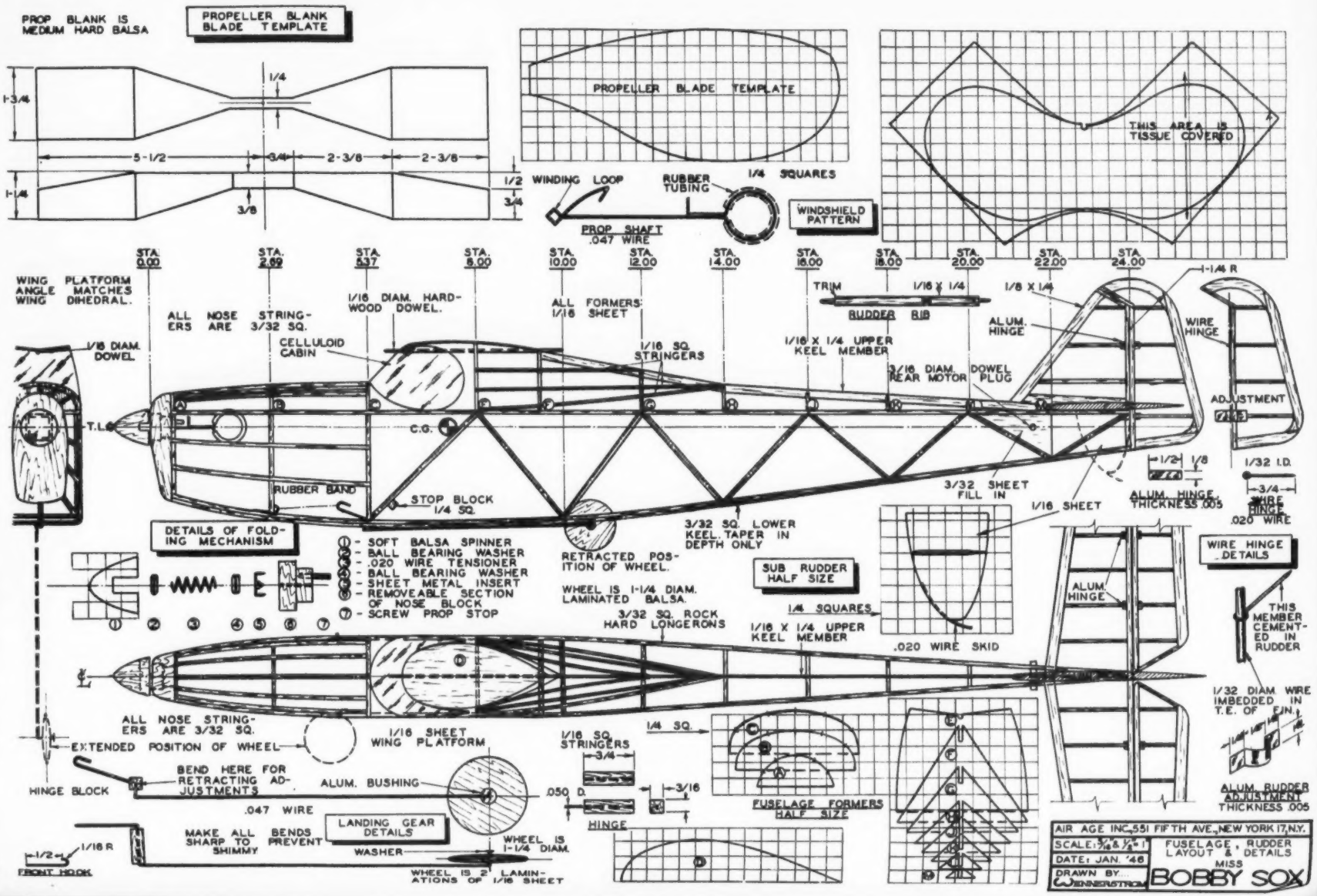
Naturally we were both thrilled with the *'Lark's* performance, and annoyed at losing it. The *Skylarks II* and *III* were finished before the end of the year and performed beautifully. The *'Lark III* had a bullet shaped nose and celluloid cabin with the box-keel construction that has characterized the entire line. We got hold of a skein 1/4 in. flat brown rubber (we got it through a friend of a friend of a friend, etc., of ours) and converted the *'Lark III* into a rubber job. The glide was terrific but the climb was somewhat slow due to the deeply undercambered airfoil and high aspect ratio (sixteen) wing used. Both the *Skylark II* and *III* were destroyed when the author got transferred. When we settled down again we went to work on *Miss Bobby Sox*. Prop-

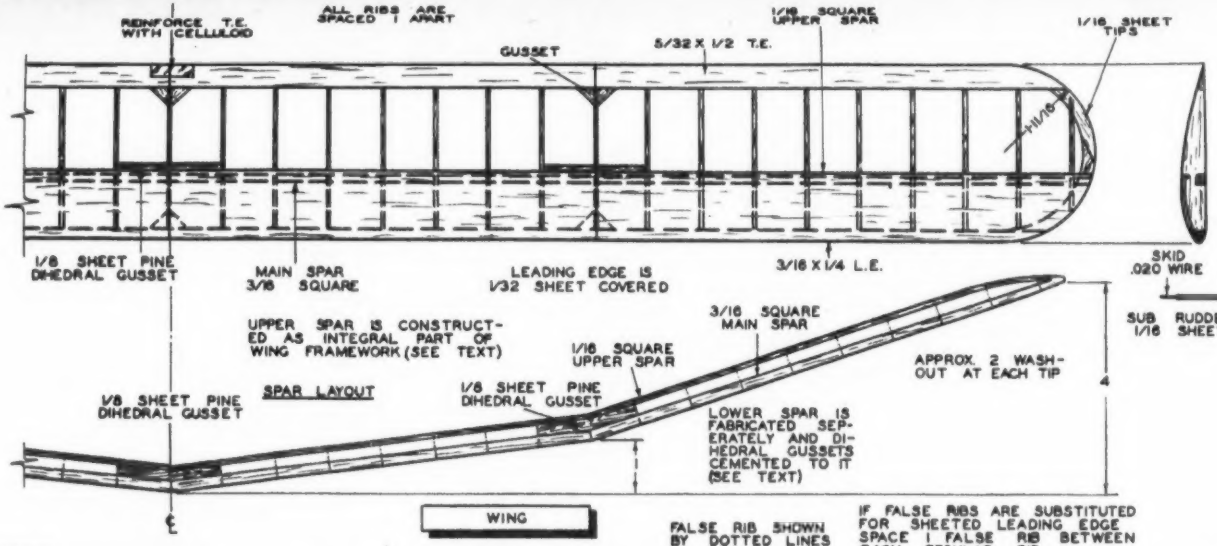
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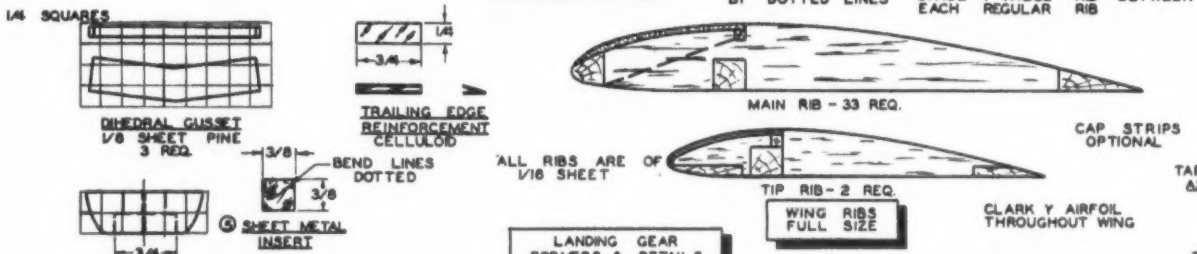


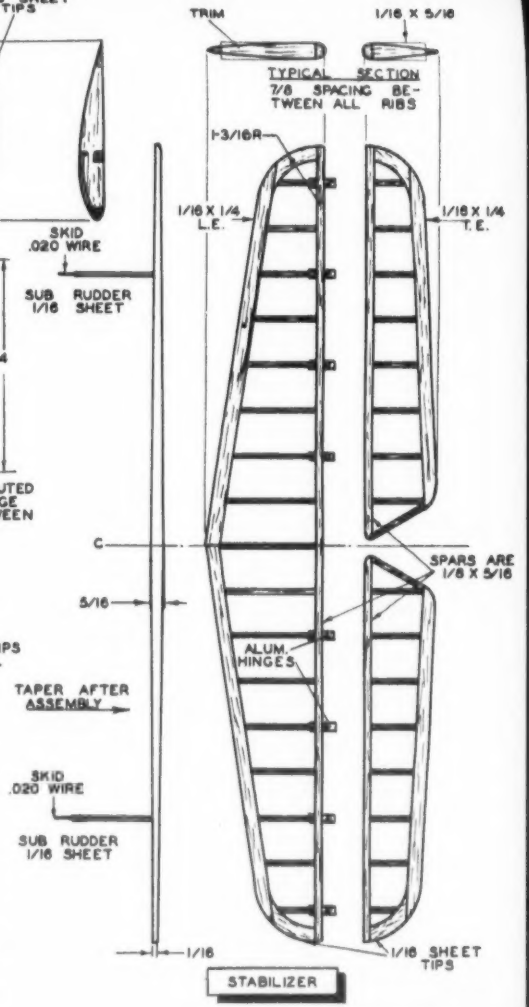





PROP BLANK IS MEDIUM HARD BALSA
PROPELLER BLANK BLADE TEMPLATE
1-3/4
1/4
5-1/2
3/4
2-3/8
2-3/8
1-1/4
3/8
1/2
3/4
PROPELLER BLADE TEMPLATE
WINDING LOOP
RUBBER TUBING
1/4 SQUARES
PROP SHAFT .047 WIRE
WINDSHIELD PATTERN
THIS AREA IS TISSUE COVERED
STA. 0.00
STA. 2.69
STA. 5.37
STA. 8.00
STA. 10.00
STA. 12.00
STA. 14.00
STA. 16.00
STA. 18.00
STA. 20.00
STA. 22.00
STA. 24.00
WING PLATFORM ANGLE MATCHES WING DIHEDRAL.
ALL NOSE STRINGERS ARE 3/32 SQ.
1/16 DIAM. HARDWOOD DOWEL.
ALL FORMERS 1/16 SHEET
TRIM
1/16 X 1/4 RUDDER RIB
1/8 X 1/4
1-1/4 R
ALUM. HINGE
WIRE HINGE
1/16 DIAM. DOWEL
CELLULOID CABIN
1/16 SQ. STRINGERS
1/16 X 1/4 UPPER KEEL MEMBER
3/16 DIAM. REAR MOTOR DOWEL PLUG
ADJUSTMENT
T.E.
C.G.
1/2
1/8
1/32 I.D.
3/4
WIRE HINGE .020 WIRE
ALUM. HINGE THICKNESS .005
RUBBER BAND
STOP BLOCK 1/4 SQ.
3/32 SHEET FILL IN
1/16 SHEET
3/32 SQ. LOWER KEEL, TAPER IN DEPTH ONLY
DETAILS OF FOLDING MECHANISM
1 - SOFT BALSA SPINNER
2 - BALL BEARING WASHER
3 - .020 WIRE TENSIONER
4 - BALL BEARING WASHER
5 - SHEET METAL INSERT
6 - REMOVEABLE SECTION OF NOSE BLOCK
7 - SCREW PROP STOP
RETRACTED POSITION OF WHEEL.
WHEEL IS 1-1/4 DIAM. LAMINATED BALSA.
SUB RUDDER HALF SIZE
1/4 SQUARES
3/32 SQ. ROCK HARD LONGERONS
1/16 X 1/4 UPPER KEEL MEMBER
.020 WIRE SKID
ALUM. HINGE
WIRE HINGE DETAILS
THIS MEMBER CEMENTED IN RUDDER
1/32 DIAM. WIRE IMBEDDED IN T.E. OF F.IN.
ALUM. RUDDER ADJUSTMENT THICKNESS .005
ALL NOSE STRINGERS ARE 3/32 SQ.
1/16 SHEET WING PLATFORM
EXTENDED POSITION OF WHEEL
1/16 SQ. STRINGERS
1/4 SQ.
3/4
3/16
.050 D.
HINGE
FUSELAGE FORMERS HALF SIZE
HINGE BLOCK
BEND HERE FOR RETRACTING ADJUSTMENTS
ALUM. BUSHING
.047 WIRE
LANDING GEAR DETAILS
MAKE ALL BENDS SHARP TO PREVENT SHIMMY
WASHER
WHEEL IS 1-1/4 DIAM.
WHEEL IS 2 LAMINATIONS OF 1/16 SHEET
1/2
1/16 R
FRONT HOOK
AIR AGE INC., 551 FIFTH AVE., NEW YORK 17, N.Y.
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SCALE: FULL SIZE	FUSELAGE DETAILS WING & STABILIZER MISS BOBBY SOX
DATE: JAN. '46	
DRAWN BY..... WENNERSTROM	

reynolds number

by W. H. S. BIRD

Why that mysterious term, Reynolds Number, is of vital interest to model builders

TAKE a look at this little formula:

$$R = \frac{\rho V l}{\mu}$$

It's very simple. But it has the most profound effect on the average model airplane from the smallest indoor creation to the six or eight foot gassie. According to standard aeronautical usage this is the formula for *Reynolds Number*, and by taking a little freedom with the classical definition it becomes, in short, actually a measurement of the aerodynamic scale effect. It is the reason your scale model does not have the same gliding angle or other flight characteristics of your pet airplane even though scaled down exactly. We will see why later.

Have you ever looked through some of the reports published by the National Advisory Committee for Aeronautics or similar organizations, trying to decide which airfoil section looked like the best bet for your next contest winner? If you have, chances are you may have noticed a notation somewhere on the diagram which may have said: "Reynolds Number 3,000,000." Chances are too that if you did notice it you just didn't bother about it or else decided it didn't matter anyway. On the contrary it matters a lot. In fact it can matter a great deal more for the model than it does for the full size airplane.

But to get back to our formula, if you look up *Reynolds Number* in a text book, you will find the following:

$$R = \frac{\rho V l}{\mu}$$

where R = Reynolds Number
ρ = mass density of the air
V = velocity of the air
μ = coefficient of viscosity of air
l = wing chord

Also, according to the books, you will find that "standard atmosphere" = 0.002378 slugs per cubic foot and 159 ft.²/sec. "Standard Atmosphere" will be defined in the books; however for the purposes of the average modeler you will not have to worry much about that. If you want to work out the formula for yourself, remember that V will have to be in "feet per second", and l in feet.

But if you don't like too much calculation here are a few versions where most of the work is done for you:

$R = 6378 \times V \times l$
where V = velocity of the air in feet per second
l = wing chord in feet

Or $R = 9354 \times V \times l$
V = Velocity of the air in miles per hour
l = wing chord in feet

Table 1 shows a few typical *Reynolds Numbers* for the purposes of comparison.

TABLE 1

	Average Chord	Speed (MPH)	Approximate R
Gliding Butterfly	2"	4.5	7,000
Indoor Flying Model	2½"	4.5	8,400
Small Flying Model	4"	7	22,000
Medium Flying Model	6"	10	47,000
Large Flying Model	8"	15	93,000
Seagull	5½"	25	110,000
Albatross	8"	45	200,000
U-Control Model	4"	60	340,000
Piper Cub (near stall)	5'	40	1,870,000
Sailplane	3'	135	3,800,000
C-54	13'	220	27,000,000

Fig. 1—Scale effect on minimum drag and maximum lift for typical airfoil

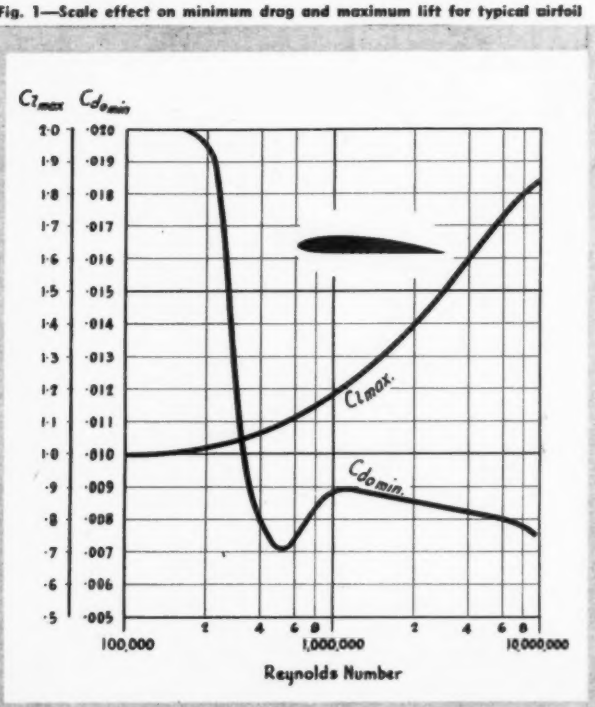
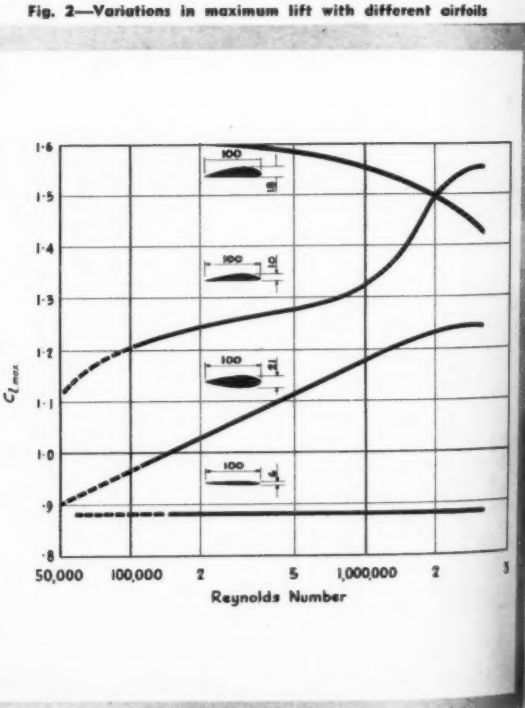


Fig. 2—Variations in maximum lift with different airfoils



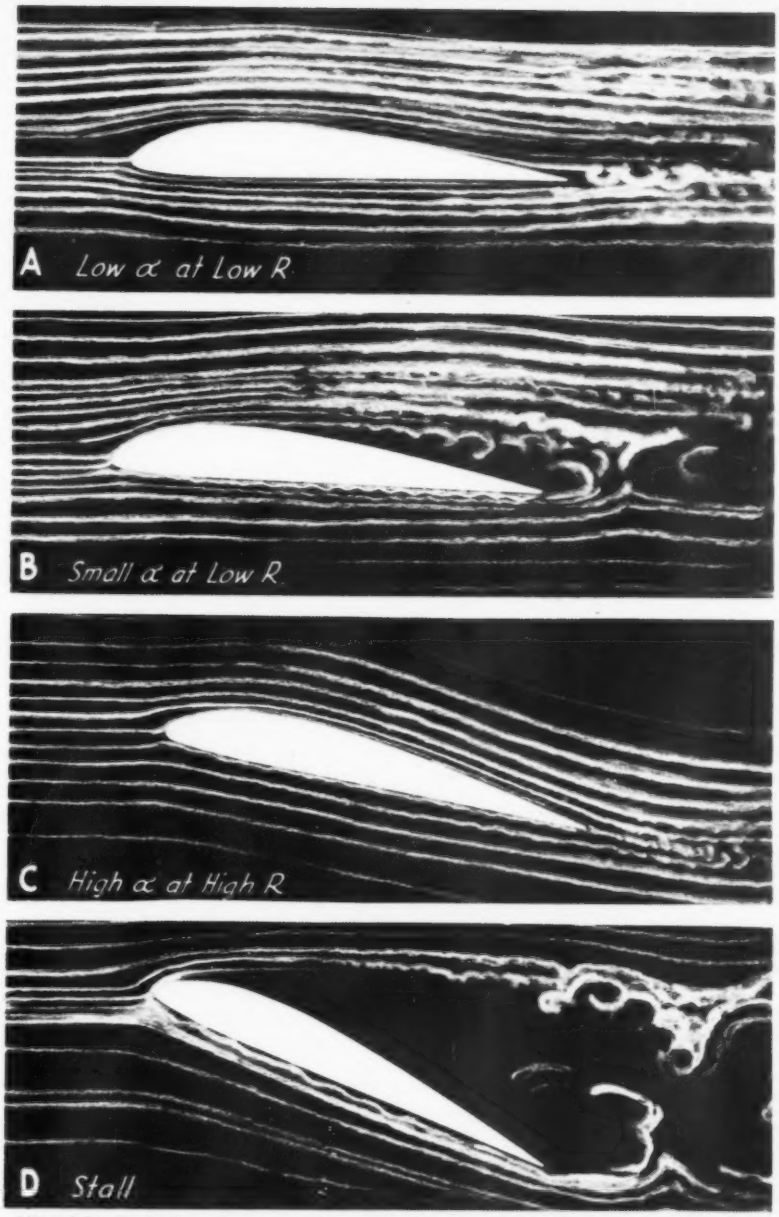
Now we can become a little more precise with our *Reynolds Number* effects. More correctly, "scale effect" is the variation of the lift coefficient (C_L) and drag coefficient (C_d) with the *Reynolds Number*. Figure 1 shows how this scale effect varies with *Reynolds Number*. For example, an aircraft with a NACA 2412 airfoil section might develop a $C_{L_{max}}$ of 1.8 at a *Reynolds Number* of 8,000,000. On the other hand, if the aircraft were reduced in size so that the $C_{L_{max}}$ would be developed at a *Reynolds Number* of 100,000, the $C_{L_{max}}$ would be only slightly over 1.0.

From Fig. 1 we can also see that for the same two aircraft the $C_{d_{min}}$ or Minimum Profile Drag Coefficient is just under 0.008 when the *Reynolds Number* is 8,000,000, rises slowly to about 0.009 at $R=1{,}100{,}000$ approximately, falls off again to about 0.007 at $R=500{,}000$, then rises quite sharply to about 0.024 at $R=100{,}000$. In other words, the drag has increased over three times, and at the same time the lift has come very close to being halved. And we are still not down into the free flight model range of *Reynolds Numbers*.

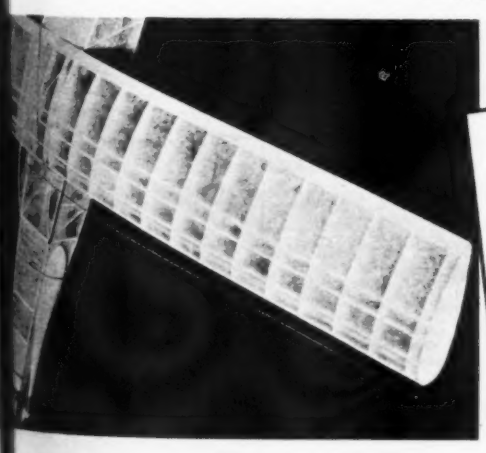
It should be remembered that this scale effect must be determined either directly or indirectly from wind tunnel tests or a full scale comparison and that it varies with different airfoil sections. Some airfoils are much worse offenders than the NACA 2412 when it comes to scale effects; and other sections have actually higher lift coefficients as models than as full scale wings. Or let's look at it another way. Suppose you have a 1/10 size flying scale model of a P-51. The wing chord on the model then is 1/10th the wing chord of the real thing, and by the "Law of Similitude" if we want to keep the *Reynolds Number* the same for the model we must multiply the speed by 10. This means that your model should have a top speed of something like 4500 mph and that it would stall at a mere 1000 mph or so. But don't waste any time trying to figure out how to get enough power to do that, for other factors besides the "Law of Similitude" enter into the picture. It can be shown fairly easily by the latter that the weight of your 1/10 scale model would actually have to be that of the real thing; that is, your 43 in. model would have to weigh something like 9000 lbs.

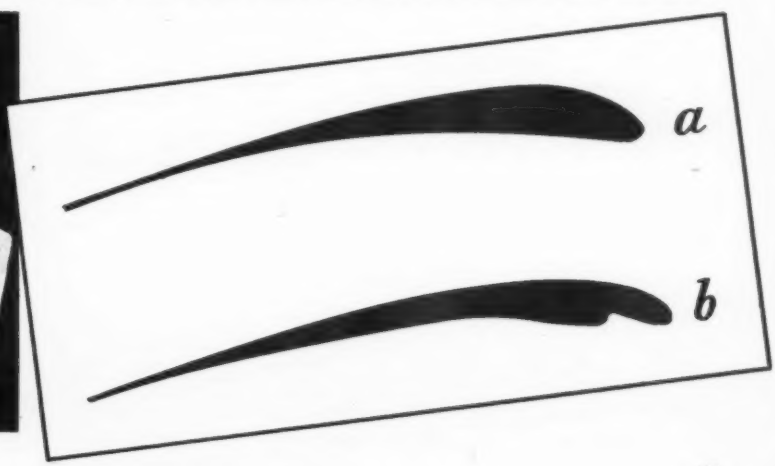
Now let's have a look at Fig. 2. Here we have some curves in which the variation of $C_{L_{max}}$ is plotted against *Reynolds Number*. The four airfoils shown are well known types, and as you can see they are all over the lot when you get down to the model aircraft range of *Reynolds Num-*

(Turn to page 72)



(Above) Fig. 3—Airflow over wing sections. (Below) Fig. 4—Wing profiles of the *Eagle* and *Vulture*. (Below left) Fig. 5—High performance model fitted with turbulence wire at nose of wing





by WILLIS L. NYE

plane drafting

PART 6—DOUBLE CURVED SURFACES

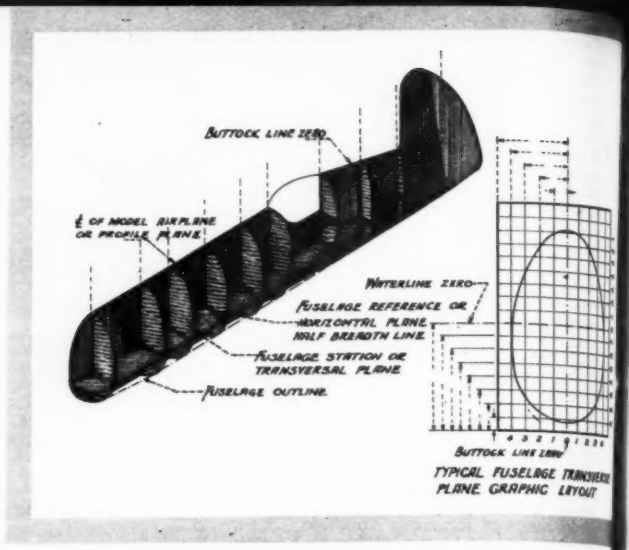


Fig. 1—Principal planes required to properly lay out a fuselage

GENERAL — Double curved surfaces are numerous in model airplane construction; they comprise the most difficult surface development to lay out and on which to make proper intersections. Their development requires accurate layout operations because the double curved surface represents height, breadth and depth which must be visualized and then drawn on a flat plane of the paper. Model airplane fuselages may vary in the crosssectional shape throughout the length as well as in upper and lower contour and thus present a double curved surface to the airstream. The lines of the model airplane fuselage are usually moderately uniform throughout the length with contraction at the aft end occurring in three dimensions.

THREE PRINCIPAL PLANES. In Fig. 1 is shown the three basic planes used to develop faired surfaces of a model airplane fuselage. By means of these three planes as the basic reference it is possible to develop the faired lines of the model airplane fuselage. The vertical center plane of a model airplane is usually designated as "B.L.O.". This vertical plane is also the profile plane, the outline of which is known as the upper or lower contour. This vertical line is also known as buttock line zero, which term is a derivative of naval architecture nomenclature and is used frequently in reference to airplane lofting operations. A buttock line is defined as a vertical cutting plane extending from nose to aft end of the fuselage. Buttock lines are numbered zero at the centerline or the center vertical plane (profile plane) and are equally spaced on either side of the profile plane. The function of the buttock line is to provide a means whereby horizontal distances or similar dimensions may be referenced along the fuselage from nose to aft end and represent imaginary vertical profile planes cutting through the fuselage. Without the use of buttock lines horizontal dimensions could not be properly made. A model airplane fuselage is usually symmetrical about the centerline.

Waterline is another term borrowed from naval architecture and is defined as a horizontal reference plane, cutting the fuselage from nose to aft end, and by means of which it is possible to measure vertical distances. The horizontal centerline of the fuselage is designated as zero. Waterlines located above the centerline are negative, those below the centerline are positive, and each waterline is designated by an appropriate sign. The distance between the geometrical location of a waterline or a buttock line is arbitrary, although the closer these planes are located the more accurate will be the final production of the faired lines or outside surfaces of the fuselage.

A third cutting plane, or what is defined as the transverse plane, is also used to designate the station points on a model airplane fuselage. Station points or planes are used in the fore and aft dimensions of the fuselage and originate at zero at the left side of the fuselage and usually progress in the cumulative dimensions toward the aft end or the empennage.

It can be ascertained that the height, length and breadth of the fuselage can be coordinated by means of cutting planes equally spaced through the structure. By means of these imaginary cutting planes, the fairing lines of the model airplane fuselage may be developed. Where great accuracy of reproduction is desirable, this method is essential and is the same as that employed on full scale aircraft.

BASIC CONTOUR LINES OF A MODEL AIRPLANE FUSELAGE—The three basic contour lines are the major linear functions in developing a properly faired model airplane fuselage. These contours are designated as the upper, lower and half breadth contours, and are obtained from the engineering drawings. The upper and lower contour lines are located

(Turn to page 46)

Fig. 2—Basic contour lines of a fuselage

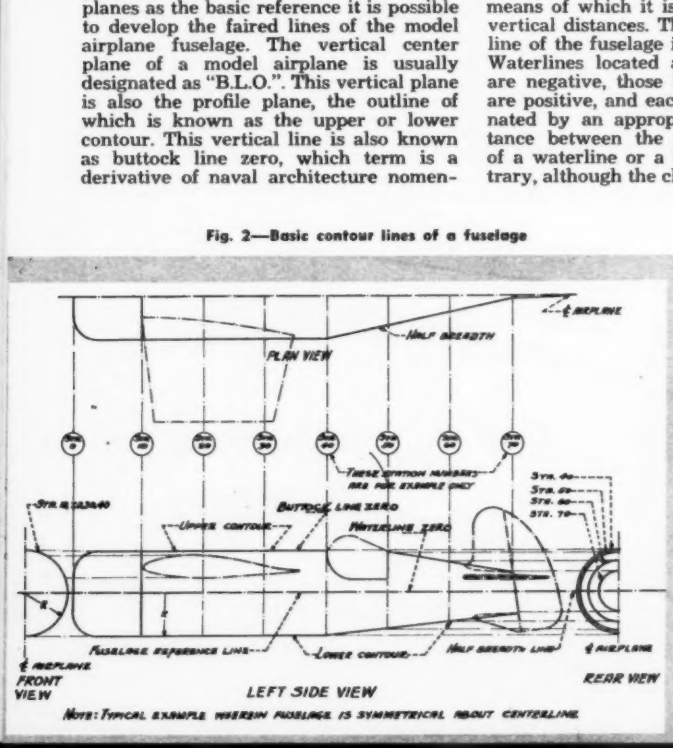
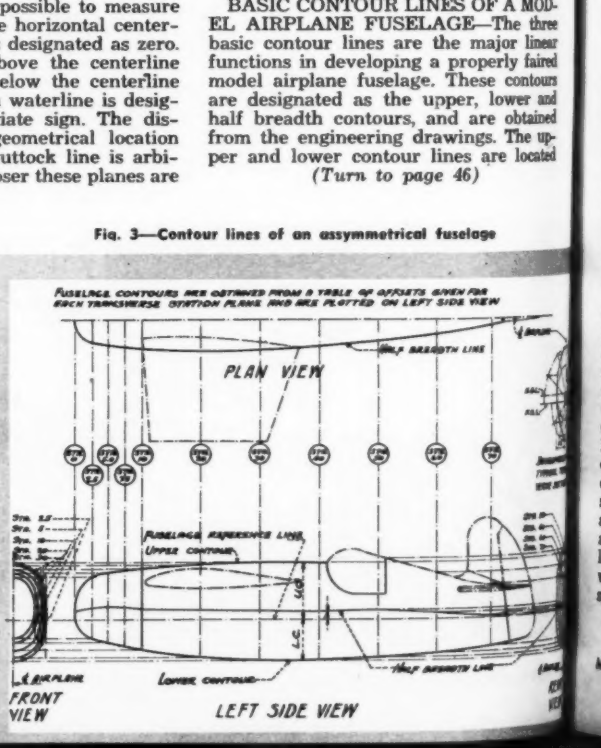


Fig. 3—Contour lines of an assymmetrical fuselage



by ROBERT CAMPBELL

PART 2

WORLD WAR I

Further details on one of the most rugged fighters of World War I, the Spad 7

ONE bad feature of most World War I aircraft was their liability to structural failure while in the air under certain combat conditions. The *S.E.5*, for instance, often shed its wings when pulled out of a high speed dive too abruptly, and sometimes a sudden zoom from high speed level flight would collapse the stabilizer. The *Albatross D.III*, when held in a high speed dive, would develop flutter in its lower wing which usually snapped that member off on all but the most gentle pull-out. And the *Nieuport 28* had the nasty habit of shedding its wing fabric when diving speeds exceeded 180 to 200 mph.

The point of this discussion is not to run down contemporaries of the *Spad S-7C.1*, but rather to point out that success or failure in individual combat often was decided months in advance on the engineer's drawing board. Whether through error or ignorance, most airplanes of the 1914-18 period had designed into them an inherent weakness, the fear of which prevented pilots from turning a few degrees tighter or pulling out faster. This involuntary restraint often prevented the pilot from getting a bead on a quarry or made him a sitting target for an opponent.

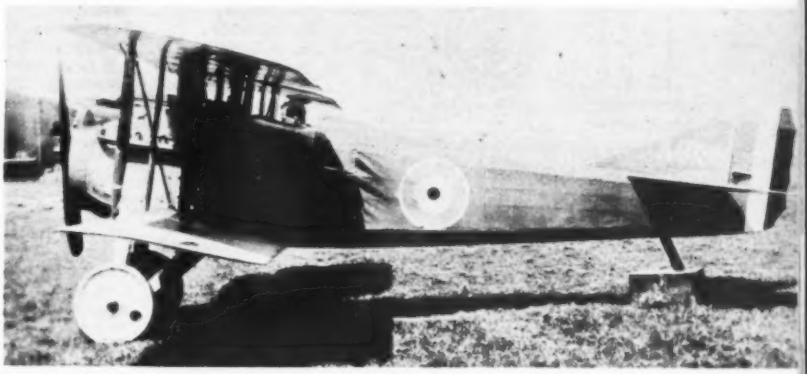
In this respect the *Spad 7* was a most remarkable airplane in that no record exists of its failure in any kind of maneuver where the structure was not previously damaged by enemy action. And the record of victories piled up by *Spad* pilots because they trusted their machine is a clear tribute to Bechereau's ability to work with wood, wire and fabric. The records hold, too, many accounts of *Spads* returning from patrol with sagging wings. In each case the ship had been maneuvered so violently that the steel strut and wire fittings pressed into the spars to create a looseness in the rigging!

Wing Construction

Many analysts have regarded the *Spad 7* structure as a rather poor example of design for production, and when compared to other designs of the same period this opinion has a certain basis of fact. The reason for the *Spad's* complex structure, however, is based on two very important considerations. First, Bechereau believed that a lot of small parts, all stressed in relation to one another, were less conducive to failure of an entire member than would be a few vital parts stressed as individual units. A branch of this theory is prevalent in modern stressed skin structures. And second, the French workmen's ability to produce small, precise parts rapidly fitted nicely into the scheme.

A good example is the *Spad S-7C.1* wings, which between the two contained 108 full ribs, 20 compression members, four main spars, six spanwise stringers and a multitude of gussets, fittings, flanges and blocks in addition to the internal wire bracing. Each rib was made of individual nose, center and trailing webs of 1/16 in. thick three ply with 1½ in. diameter lightening holes spaced on 2½ in. centers. Full chord top and bottom cap strips of spruce held the webs in place and were tacked and taped to the spars and stringers. In addition to the two hollow main spars in both wings, the upper wing was equipped with an auxiliary spar to which the ailerons were hinged.

(Turn to page 68)

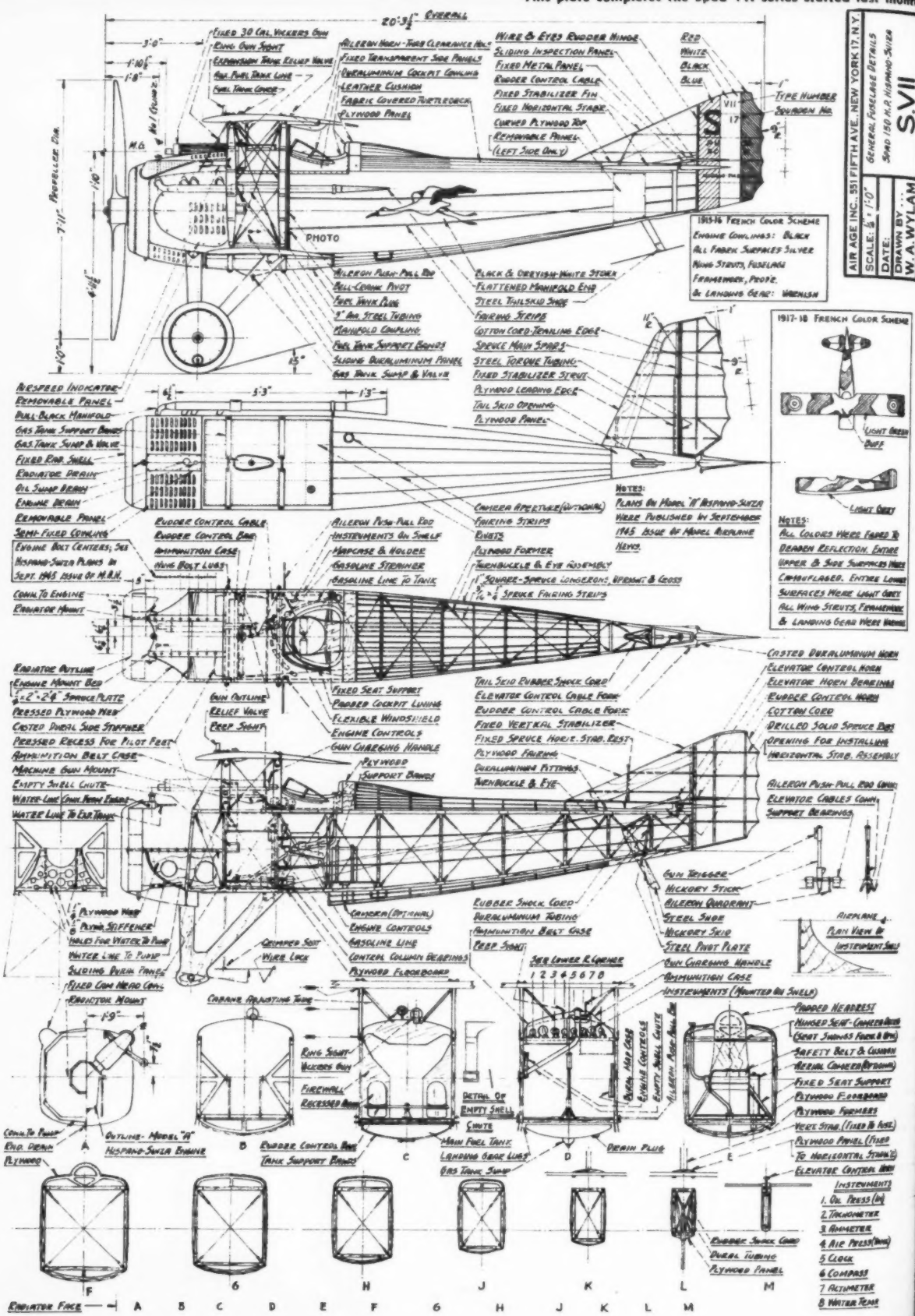


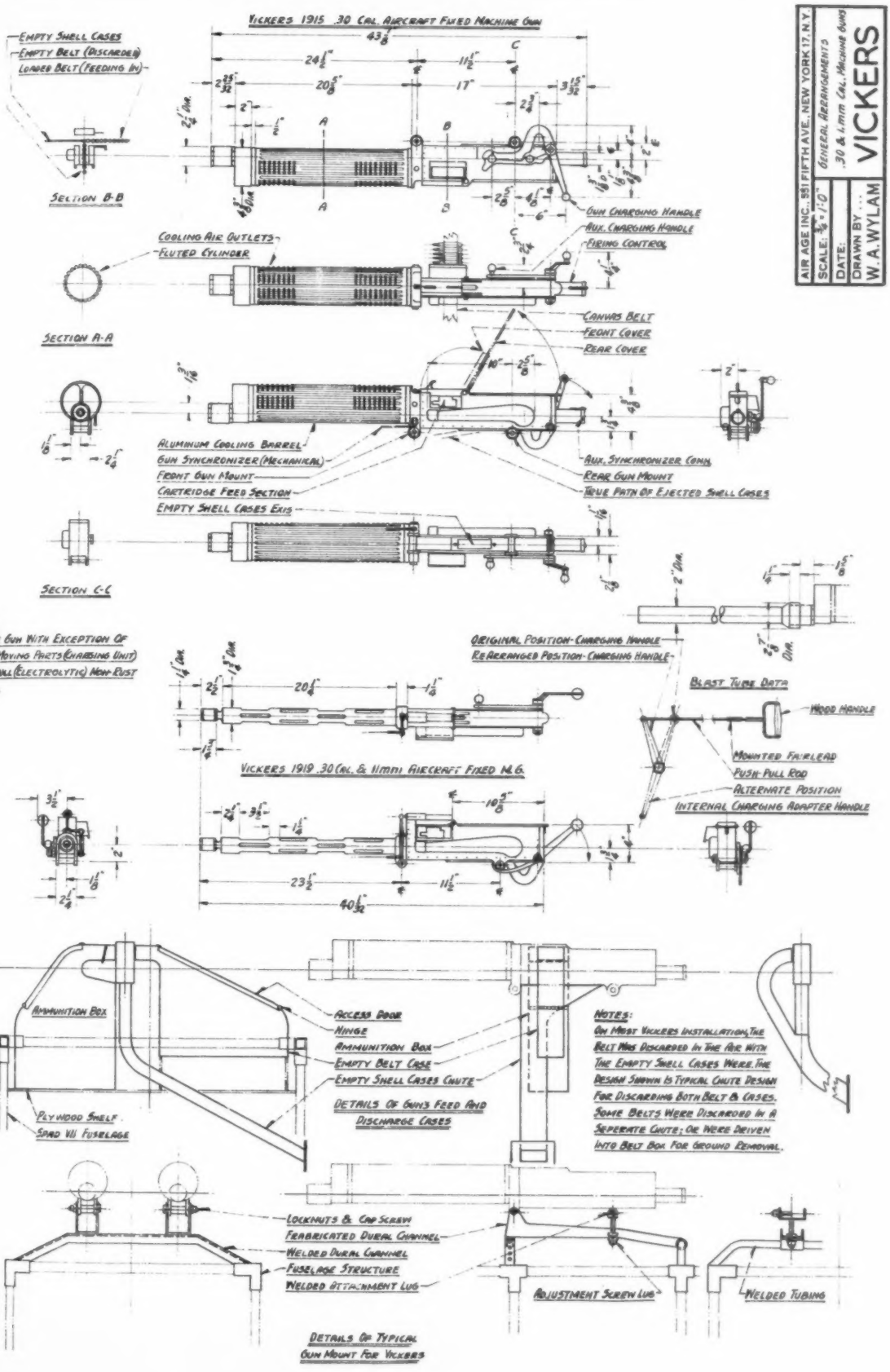
British built Spad 7 with Hispano Suiza 140 hp motor



Above—Last model built was this 205 hp Spad S-7C.1. Below—British built Spad 7 with Hisso 180 hp motor; this type of fighter was used in the defense of London




S.VII
AIR AGE INC., 551 FIFTH AVE., NEW YORK 17, N.Y.
SCALE: 3/4" = 1'-0"
DATE:
DRAWN BY W. A. WYLAM
GENERAL FUSELAGE DETAILS
SPAD 150 H.P. HISPANO-SUIZA
OVERALL
PROPELLER DIA.
PHOTO
1915-16 FRENCH COLOR SCHEME
ENGINE COWLINGS: BLACK
ALL FABRIC SURFACES SILVER
WING STRUTS, FUSELAGE FRAMEWORK, PROPS, & LANDING GEAR: VARNISH
1917-18 FRENCH COLOR SCHEME
LIGHT GREEN DUFF
LIGHT GREY
NOTES:
PLANS OF MODEL "A" HISPANO-SUIZA WERE PUBLISHED IN SEPTEMBER 1945 ISSUE OF MODEL AIRPLANE NEWS.
NOTES:
ALL COLORS WERE FADED TO DEADEN REFLECTION. ENTIRE UPPER & SIDE SURFACES WERE CAMOUFLAGED. ENTIRE LOWER SURFACES WERE LIGHT GREY
ALL WING STRUTS, FRAMEWORK & LANDING GEAR WERE VARNISH
RADIATOR FACE
A
B
C
D
E
F
G
H
J
K
L
M

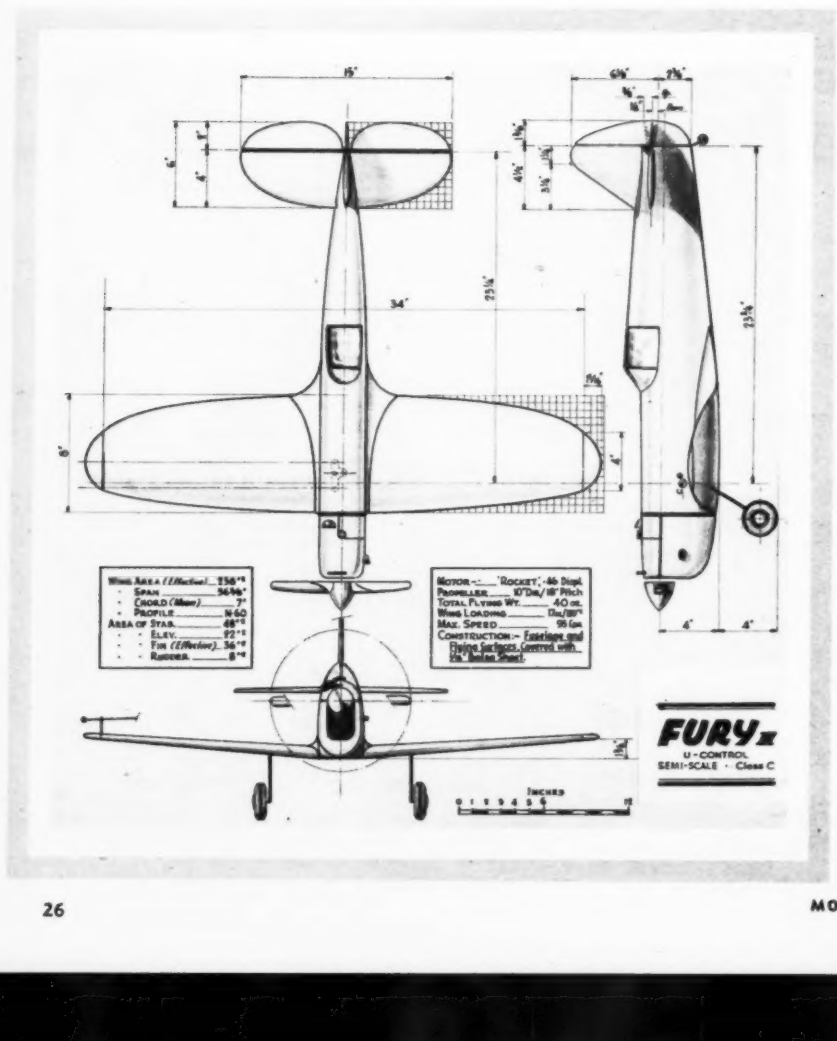

VICKERS 1915 .30 CAL. AIRCRAFT FIXED MACHINE GUN
EMPTY SHELL CASES
EMPTY BELT (DISCARDED)
LOADED BELT (FEEDING IN)
SECTION B-B
GUN CHARGING HANDLE
AUX. CHARGING HANDLE
FIRING CONTROL
COOLING AIR OUTLETS
FLUTED CYLINDER
SECTION A-A
CANVAS BELT
FRONT COVER
REAR COVER
ALUMINUM COOLING BARREL
GUN SYNCHRONIZER (MECHANICAL)
FRONT GUN MOUNT
CARTRIDGE FEED SECTION
EMPTY SHELL CASES EXIT
AUX. SYNCHRONIZER CONN.
REAR GUN MOUNT
TRUE PATH OF EJECTED SHELL CASES
SECTION C-C
AIR AGE INC., 551 FIFTH AVE., NEW YORK 17, N.Y.
SCALE: 3/4" = 1'-0"
DATE:
DRAWN BY: W. A. WYLAM
GENERAL ARRANGEMENTS
.30 & 1.mm CAL. MACHINE GUNS
VICKERS
NOTE:
ENTIRE GUN WITH EXCEPTION OF STEEL MOVING PARTS (CHARGING UNIT) WAS DULL (ELECTROLYTIC) NON-RUST BLACK.
ORIGINAL POSITION-CHARGING HANDLE
RE-ARRANGED POSITION-CHARGING HANDLE
BLAST TUBE DATA
WOOD HANDLE
MOUNTED FAIRLEAD
PUSH-PULL ROD
ALTERNATE POSITION
INTERNAL CHARGING ADAPTER HANDLE
VICKERS 1919 .30 CAL. & 11mm AIRCRAFT FIXED M.G.
AMMUNITION BOX
ACCESS DOOR
HINGE
AMMUNITION BOX
EMPTY BELT CASE
EMPTY SHELL CASES CHUTE
PLYWOOD SHELF
SPAD VII FUSELAGE
DETAILS OF GUN'S FEED AND DISCHARGE CASES
NOTES:
ON MOST VICKERS INSTALLATION, THE BELT WAS DISCARDED IN THE AIR WITH THE EMPTY SHELL CASES. WHERE THE DESIGN SHOWN IS TYPICAL CHUTE DESIGN FOR DISCARDING BOTH BELT & CASES. SOME BELTS WERE DISCARDED IN A SEPERATE CHUTE; OR WERE DRIVEN INTO BELT BOX FOR GROUND REMOVAL.
LOCKNUTS & CAP SCREWS
FABRICATED DURAL CHANNEL
WELDED DURAL CHANNEL
FUSELAGE STRUCTURE
WELDED ATTACHMENT LUG
ADJUSTMENT SCREW LUG
WELDED TUBING
DETAILS OF TYPICAL GUN MOUNT FOR VICKERS

by J. S. LUCK

PART 2

A typical sport control liner is discussed with reasons given for the various features of design and construction

control line



SINCE last month the reader spent a number of gratifying hours becoming acquainted with the technique of control line flying. His basic trainer has served him well and has imparted wisdom to its guiding hand. The fledgling, having earned his wings, is at last ready to devote his new-found skill to a ship of sleeker, racier lines.

Perhaps at this point some of the more ambitious pilots may feel qualified to forego the intermediary step and start right in building a *Super Snarler* (an imaginary aerotrocity of 16 in. span, guaranteed to exceed 250 mph with a P & W *Double Wasp)*, but the wiser fan will recognize the value of a complete training before attempting a racing job and so will eagerly search for a control line design best suited to his advancing proficiency. These fellows will be happier in the long run for they are to become acquainted with the most exciting phase of control line flying. It is with the advanced control line model that all those hair-raising stunts become possible and that alone probably explains why so many fans never do progress any further toward piloting even speedier ships, not because they failed to gain a complete mastery of the technique, but rather because they were content, or even eager, to apply their talents to the execution of more and more difficult maneuvers with ever increasing precision. There is some sense to this, for nothing can be more tedious than watching a speed model whizzing round 'n round until bored spectators become as dizzy as they imagine the pilot to be and fervently pray for a crash landing or a broken line to relieve the monotony.

THE PLANE—In main essentials, the efficient, manageable sport plane varies little from the low-powered trainer. True, the expected greater speed permits a slightly higher wing loading—a concession rather than a rule, while the power loading will probably decrease, but otherwise, force arrangement, wing area and general control line layout practice remain the same. As already mentioned in Part I, Earl Cayton's *Tethered Trainer* which turns in an admirable performance with a motor of .19 cu. in. displacement, becomes a fine stunt plane with a .29 to .46, and a regular little speed demon with a "sixty." Bearing this in mind it is possible to lay down a set of specifications for a model calculated to provide graceful flying qualities and yet, should occasion or desire command, be right up front with the best of them when the heat is really on.

The *Fury III* shown generally in this article is specifically intended to put on as good an exhibition at the end of 50 to 80 feet of steel control line as it does on a show table. Keeping in mind the prerequisite of all sound design—*Form Follows Function*—she was built a little sturdier than would be strictly necessary in a primary trainer whereas the contours were sweetened up only as much as efficiency would allow. The chosen layout thus became a thoughtful compromise in which the fanciful "Dream Ship" was carefully checked by practical control line considerations and she is, therefore, a good airplane to use as a basis for the specifications of any design in this particular class.

DESIGN—When designing a control line model by far the most important decisions to be reached are in regard to the wing, and its requirements will be discussed here in some detail.

Wing area, profile and planform must

be selected with due regard to intended function. All this could be done with mathematical precision based upon formulae relating to *Low Speed* Aerodynamic fact and theory; but even assuming an ultimate degree of accuracy the results still remain largely theoretical and therefore hardly of sufficient value to warrant the complex calculations involved. As long as no really bad aerodynamic transgressions are committed it is sufficient to lean heavily upon precedent and merely copy or adapt a successful design to please the designer's pet personal theories or his imagination. Before jeering "Shame!" or "Pirate!" consider carefully that nearly all full size aeronautical designing is a highly developed form of plagiarism and most new airplanes feature a bit of this ship and a bit of that, or once a successful type has been evolved many others follow suit—to the layman there is not so much difference between a *Piper Cub, Aeronca Champion, Taylorcraft, Stinson,* et al.—and accepted practice in full size designing should certainly be no disgrace in model work. The *Fury III* itself reached its present state of development through a study of its predecessors and then adapting certain desirable features of each to a "new" design. No one can question the right to copy its force arrangement any more than the *Fury III* should be ashamed of a resemblance to both the *Fury mark I and II.*

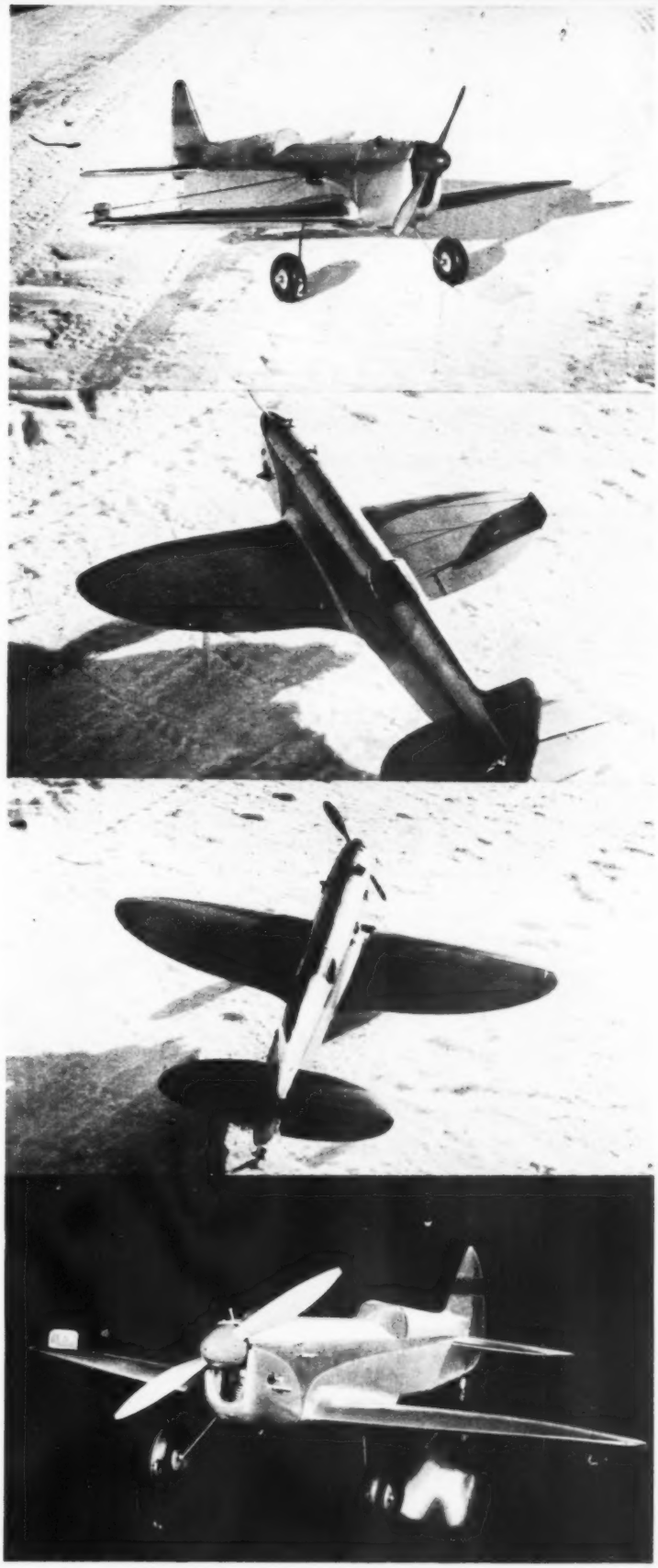
From past experience it seems that the wing loading must not exceed 20 oz./100"^{2} and would be all the easier to handle if that loading was reduced to 15 oz./100"^{2}. A reasonable allowance for the ready-to-fly weight of an average model is 36 oz, a wing area of 238 in. would therefore give a desirable loading. This is a small wing, so its Aspect Ratio must be low—about 4½ or 5 to 1—therefore the ideal wing is a rectangle* of 34" x 7". As the rectangular wing *looks* clumsy, and the true elliptical plan is inefficient, a compromise is made by scribing an oval in which the tips are filled out to give as large a chord as possible for the greatest part of the span, thus reducing loss of lift at the tips when they fall below the critical Reynolds Number.**

Finally the wing profile is selected and upon a wise choice can depend so much more than far too many model designers would admit to being the case. The airfoil with convex lower camber—so termed fast sections—are definitely of no practical value to the designer of any model except, perhaps, those intended to break speed records. The L/D ratio in the lower range of the aerodynamic scale, i.e., ∠ R 200,000 is so much in favor of the flat — Clark Y type, or those of slightly concave lower curvature—N-60, U.S.A. 27, etc., that the NACA 23012 type or the control line favored M-6 wing profile can be considered as eliminated from the range of desirable sections. Every designer has a pet airfoil, and providing its parameters approximate those of the usable sections mentioned above, it can be successfully employed. A painstaking and extensive search of many reports giving the low speed characteristics of literally dozens of airfoils narrowed the selection for the *Fury III* to the N-60 and the NACA

*Contrary to popular belief, the elliptical planform is not the most efficient for model work. Nature gave its finest soaring birds an almost rectangular wing because of its greater effectiveness in the lower region of the aerodynamic scale. Large soaring birds and model airplanes are in about the same part of that scale.

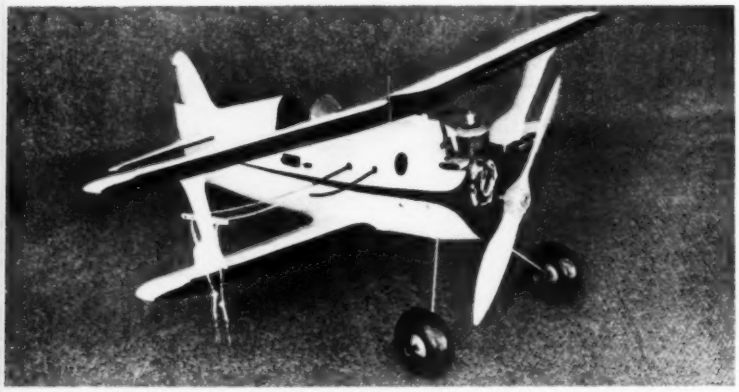
**A more complete explanation of scale effect is given in W. H. S. Bird's article in this issue.

(Turn to page 43)



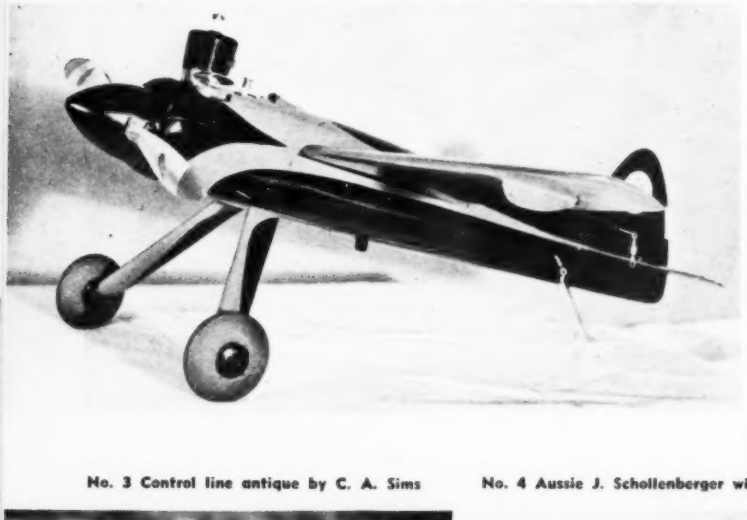
air ways

News of model airplane experimenters from all over the world

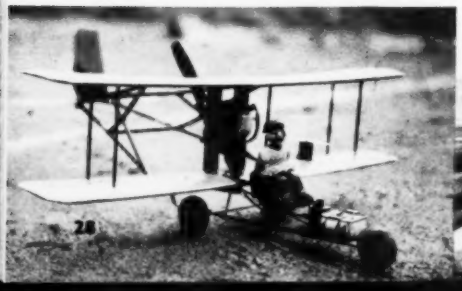


No. 1 Builder C. Saatkamp claims fine performance for this modified *Knight Twister*

No. 2 Jack Reynolds' midwing liner has made over 100 mph with dolly takeoff



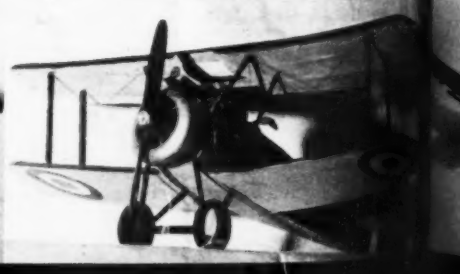
No. 3 Control line antique by C. A. Sims



No. 4 Aussie J. Schollenberger with glider



No. 5 Detailed *Camel* by R. A. Dinkel



WE PRESENT in this issue the first of what will probably be to many model builders a completely new idea in model design. We refer to the article by W. H. S. Bird on page 20 which gives a few ideas on the application of that mysterious term "Reynolds Number" to the uses of the model airplane building fraternity.

Let us state now that the same subject has been presented before in MODEL AIRPLANE NEWS. However, recent investigations have brought out new angles which help to explain some of the queer actions that builders have noticed in their models and which could not be explained by the more common rules.

After reading the aforementioned discussion, model engineers will be astonished to find that some of their most cherished rules have been applied inefficiently, or even in reverse! The more cynical will of course say: "Well, my model flies, doesn't it?". And the well informed can only answer that the model flies in spite of the obvious infractions.

We find for example that aside from the fastest control liners, most slow speed models should use a rectangular shaped wing rather than the popular elliptical or highly tapered planform. The reason is simply that the wing tips, where the chord is considerably reduced, are travelling in a continuous stall—the overall efficiency of the wing would be greatly increased if the tips were simply sawed off!

Many will wonder why these facts which seem so obvious to us now have been neglected for so long. The obvious reason, of course, is that from the beginning of aviation, model plans have been just what the term implies—models and often exact copies in every detail. Among other features thus copied were the airfoils used in big plane practice, and it was here that we made our most grievous mistake. It was not until investigators dug into the subject of low speed aerodynamics that the startling facts began to develop. In general, the subject is not of much interest to large plane engineers since their wing sections are above the critical Reynolds Number no matter what the speed may be. This is not true in the model field and it is here that the new conceptions will be of greatest use.

There are, of course, many airfoils that are ideal for model use, but most of those used in big plane practice definitely are not, and this includes the now popular laminar flow shapes. We suggest therefore that modelers digest Mr. Bird's article, then set out to shape an airfoil that is really suited for low speed use rather than copy one from large plane practice which will probably be highly inefficient when scaled down to model size.

* *

Picture No. 1 sent in by C. W. Saatkamp, 2977 N. Bartless Ave., Milwaukee 11, Wisc., shows a U-control ship, a somewhat modified *Knight Twister*. It is sky blue with dark blue trimming and powered by a pre-war Bunch *Tiger Aero*. Its average speed is around 60 mph and the model glides and settles after motor cut-

off "almost perfectly" according to its builder.

Jack Reynolds, 1234 No. Oxford St., Indianapolis, Ind., sent in No. 2. This ship was originally designed while Jack was still serving with Gen. Arnold but he didn't get around to completing the model until that "honorary degree" came through. The model is powered by an Ohlsson *60 Special;* wingspan is 24 in.; length 20½ in. With a dolly takeoff it made 101 mph, which is pretty good. In 30 flights to date it hasn't had one mishap. Here's wishing it many more successful runs.

The control line antique in No. 3 submitted by C. A. Sims, 103 S. 9th St., Tacoma 2, Wash., has been flying for a long time and caused quite a furor in the neighborhood, according to the maker, with everyone wanting to build a duplicate. We didn't get any more detailed data so we can't pass it on to you.

No. 4 sent in by John G. Schollenberger, Karelon, 24 Through Rd., Burwood E13, Victoria, Australia, is a glider, 6 ft. long and one that took two years to complete. "The chord is 8 ft., length 52 in. and weight 18 oz.", states the contributor. At first this ship had a few crack-ups but after much diligence the model was rehabilitated and is making "its mark" again.

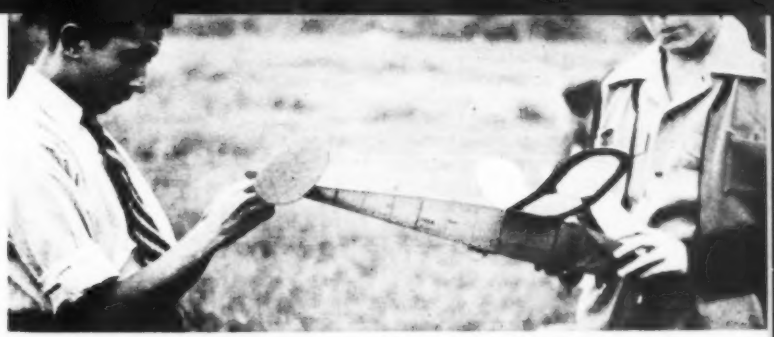
And R. A. Dinkel, 1733 Jefferson, Grand Rapids 7, Mich., who has contributed to MODEL AIRPLANE NEWS in the past, decided to try to get his "picture in the paper." This Sopwith *Camel,* No. 5, which we think is pretty near tops, took three months to build and has rubber tubing wheels with spokes and a pilot in the cockpit. "It is quite a detailed little number," says Mr. Dinkel, "and a ship I'm mighty proud to say is mine." Looked good to us, too.

A solid *Stuka* shown in No. 6 was Tommy Allen's "brainchild." Mr. Allen, Box 176, Delray Beach, Fla., writes: "This ship has cockpit controls consisting of control column, bucket seat, rudder pedals, gunners seat (which turns 180 degrees), machine gun on mount and safety belts on seats. The wheels are turnable, the bomb under body releases and swings down. The model has 22½ in. wingspan." We haven't seen the original but the picture looked too good to pass up in *Airways.*

No. 7 by Hugh McClain, 2213 S. Red Road, Coral Gables, Fla., is a single *Elf* gas model with 40 in. wingspan, 200 sq. in. wing area and weighs 14 oz. It has been flying for a number of years but doesn't any longer. Mr. McClain writes: "I've been a M.A.N. fan for as long as I can remember but this is the first time I tried to get anything in the magazine." Well, it was a good try!

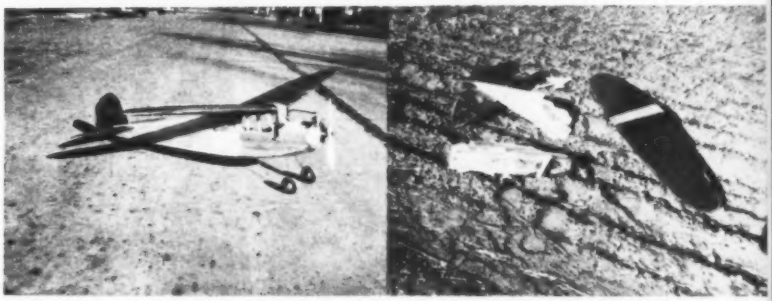
The Bristol *Beaufort* with 28 in. wingspan in No. 8 is Richard Eimert's, 139 76th St., N. Bergen, N.J. It took three months of steady work to complete this little ship and features retractable landing gears with automatic doors. "The rear

(Turn to page 50)



No. 11 A. Guera (left) and C. Maintua of Peru adjust model made from MAN plans

No. 10 Before and after! Strong wind did this to free flight gassie of Bob Greenwood who sent these shots in after the fatal third flight



No. 9 Joe Reilly won appearance event with this 38" span control line speedster



No. 6 Tom Allen built this solid *Stuka*



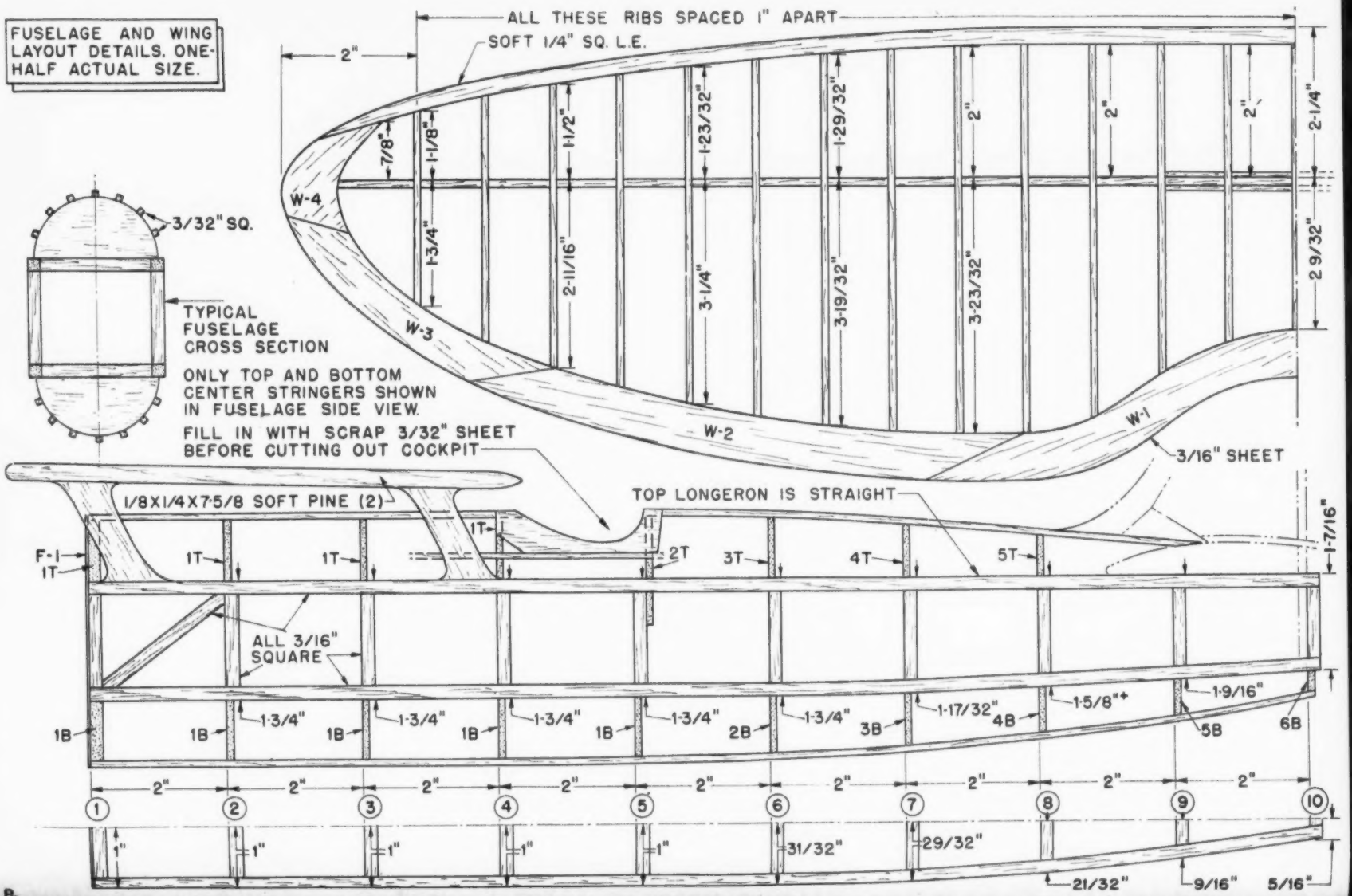
No. 7 *Elf* free flighter by H. McClain



No. 8 Scale *Beaufort* of Dick Eimert



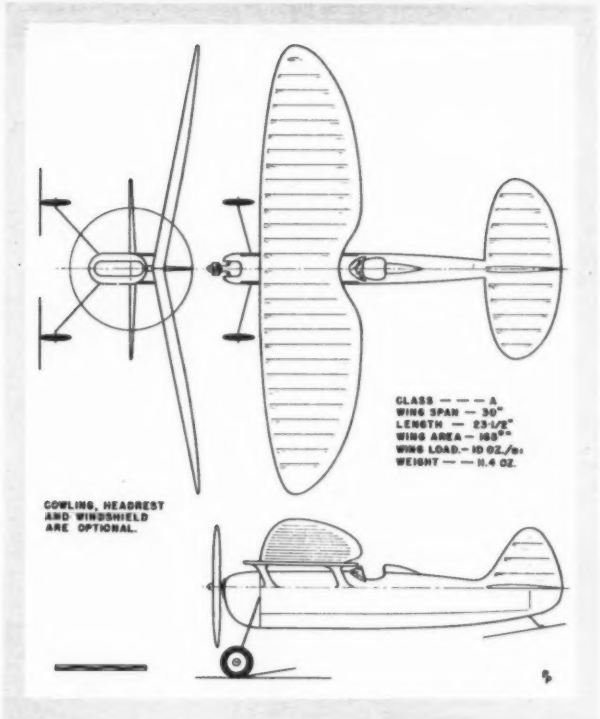
FUSELAGE AND WING LAYOUT DETAILS. ONE-HALF ACTUAL SIZE.



by PAUL PLECAN

tornado

This will provide Class A fans with fine performance and good looks









AMONG free flight gas models *Tornado* represents the minimum in size that can be built consistent with stability and performance. The first consideration in a really small model is wing tip vortices and maximum wing area per unit wing span. To cut down the tip vortices, an elliptical plan form is employed in the wing design. This also helps keep the major chord of the wing approximately one-third of the way out on each wing panel, the most efficient portion of the wing.

Due to turbulence from the propeller and to the proximity of the fuselage, a cut-out is made in the centersection, cutting down the area of this relatively inefficient part. A good-looking model *Tornado* will nevertheless look best when fitted with a windshield, headrest, full cowling and prop spinner. These items are optional, dependent upon the modeler's whims. The type of engine used will determine to a large extent the possibility of a full cowling, as the gas and timer controls will have to be easy to get at irrespective of cowling design.

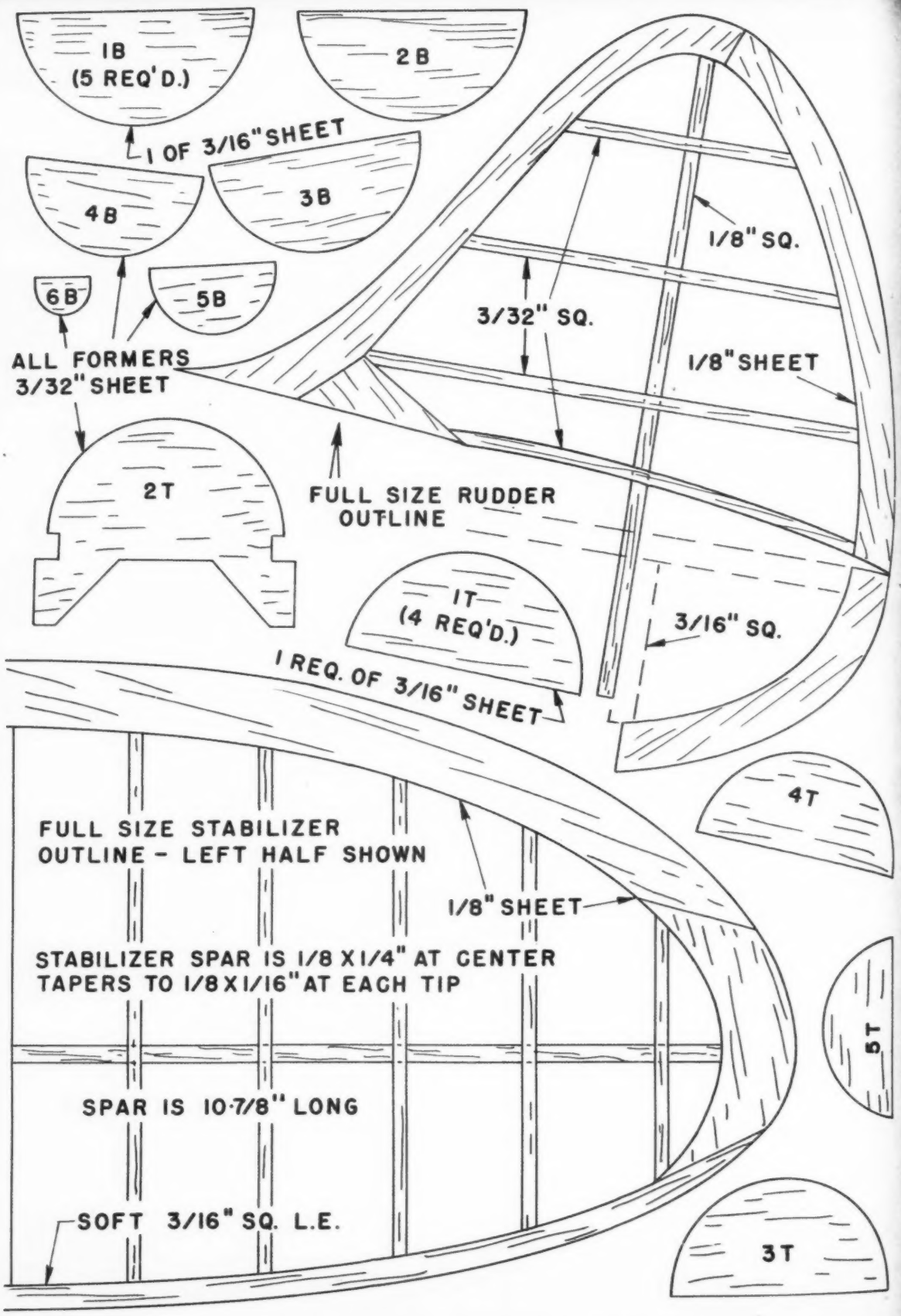
The original *Tornado* was worked out when the first *Bantam* engine appeared on the market, and it should be more successful when fitted with the ultra-light *Atom* engine since the wing loading will be smaller, a serious consideration in a small model—most "small" designs are a bit on the fast side. For an extremely easy starting engine, the *Elf* single can be recommended. Then, if desired, control lines can be fitted if you don't want to take chances on an out-of-sight free flight model.

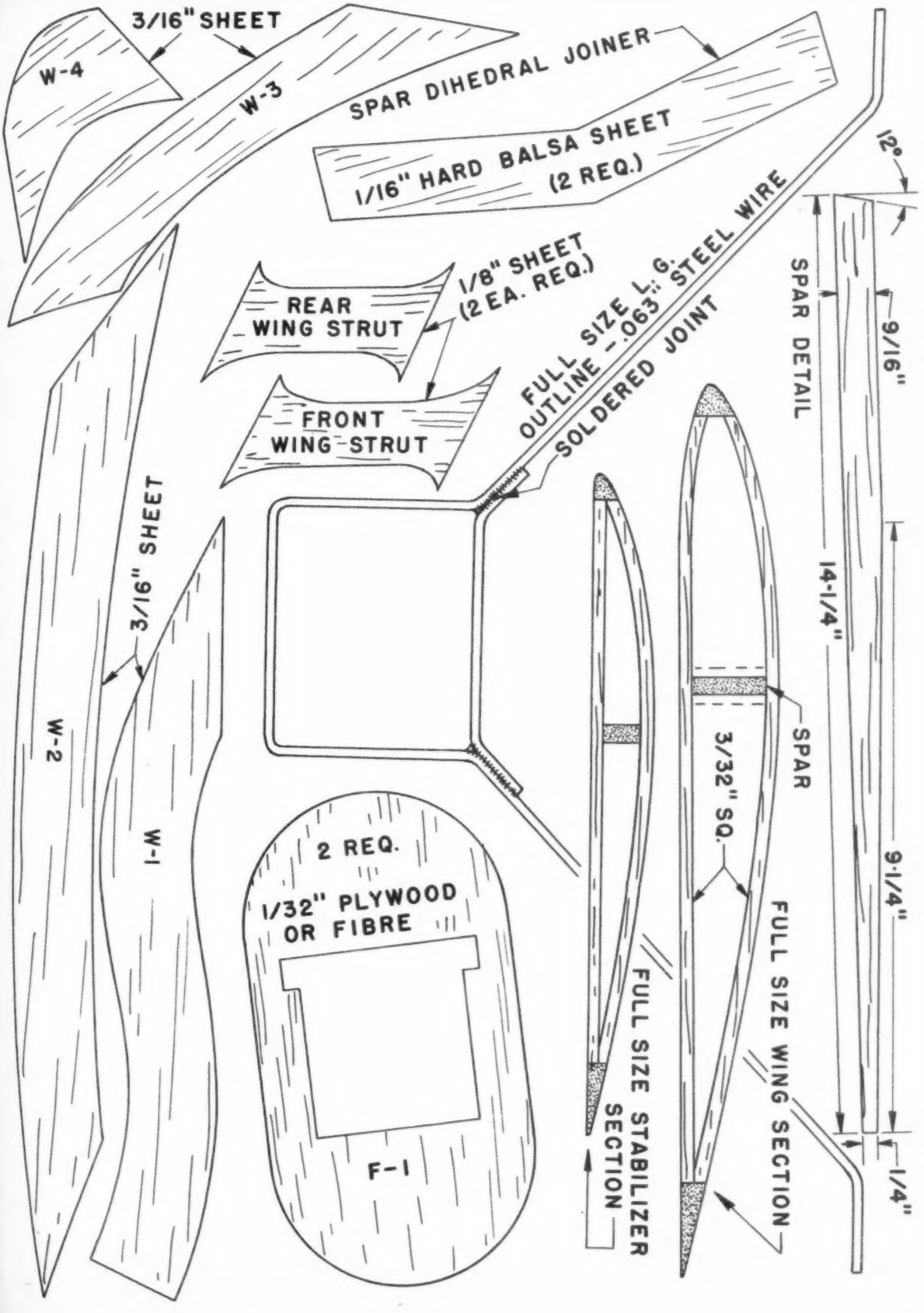
Since the average model builder appreciates full size outlines and drawings, the more difficult outlines are given actual size in the magazine plans. Note that the fuselage plan is the only drawing you'll have to make up yourself. Once that is done we can go ahead with construction.

FUSELAGE—The main frame of 3/16 in. sq. balsa is first assembled over the full size fuselage plans, care being exercised to see that the top longeron is as straight as possible. A bend in this section will throw the stabilizer incidence "out of kilter." When two sides have been built pin down to the workbench in an inverted position and cement the cross-braces in place. Before removing the fuselage frame from the bench, cement in place all bottom formers (1B to 6B) and add the 3/32 in. sq. stringers. When the cement has dried, the framework can be removed from the bench and the upper portion of the fuselage added. Once the formers and stringers are in place, the area around the cockpit can be "filled in" with 3/32 in. scrap sheet of moderate softness. When the cement has dried the area can be sanded smooth and a cockpit opening cut out. Note that the 3/32 in. sq. stringers along the top of the fuselage are not trimmed at the aft end until the stabilizer is covered and mounted in place. Now cut F-1 from thin plywood or fibre and cement to the front end of the fuselage. The wing mount is assembled next, and if you want a little extra strength the nose section and the area around the wing mounts can be "filled in." Take care to get the shape of the wing mountstruts exact as the incidence of the wing mount should be just as shown on the plans unless you want to do some experimenting yourself.

TAIL SURFACES—Construction of the tail surfaces is of the simple built-up type. A full size outline for half the stabilizer is given—trace the outline on some thin paper and invert it to obtain an entire stabilizer plan. The outline of the stabilizer is pinned down first and strips of 3/32 in. sq. are trimmed to length and fitted in place to form the bottom part of each rib. The spar is now tapered to the necessary size and cemented in place

(Turn to page 86)


1B
(5 REQ'D.)
2B
1 OF 3/16" SHEET
4B
3B
6B
5B
ALL FORMERS
3/32" SHEET
1/8" SQ.
3/32" SQ.
1/8" SHEET
2T
FULL SIZE RUDDER
OUTLINE
1T
(4 REQ'D.)
3/16" SQ.
1 REQ. OF 3/16" SHEET
4T
FULL SIZE STABILIZER
OUTLINE - LEFT HALF SHOWN
1/8" SHEET
STABILIZER SPAR IS 1/8 X 1/4" AT CENTER
TAPERS TO 1/8 X 1/16" AT EACH TIP
5T
SPAR IS 10-7/8" LONG
SOFT 3/16" SQ. L.E.
3T


3/16" SHEET
W-4
W-3
SPAR DIHEDRAL JOINER
1/16" HARD BALSA SHEET
(2 REQ.)
12°
1/8" SHEET
(2 EA. REQ.)
REAR
WING STRUT
FRONT
WING STRUT
FULL SIZE L. G.
OUTLINE - .063" STEEL WIRE
SOLDERED JOINT
SPAR DETAIL
9/16"
14-1/4"
9-1/4"
1/4"
3/16" SHEET
W-2
W-1
SPAR
3/32" SQ.
2 REQ.
1/32" PLYWOOD
OR FIBRE
F-1
FULL SIZE STABILIZER
SECTION
FULL SIZE WING SECTION

know nylon

by E. J. WEATHERS

Tests of this new covering material show great promise

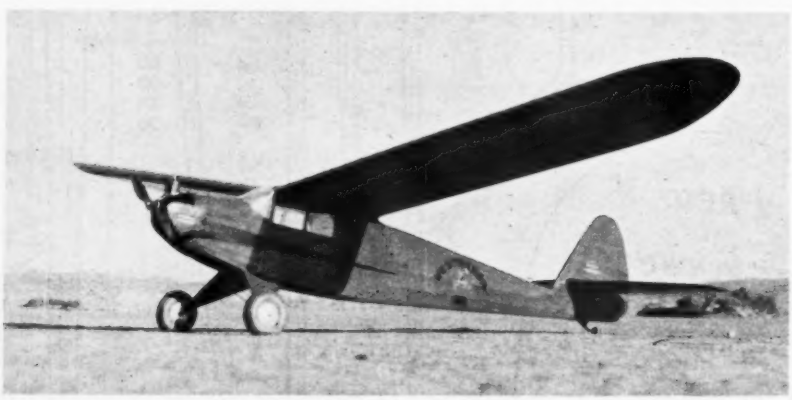
EVER think about using *Nylon* for covering models? Well, neither did I until I ran up against a tough covering problem.

In May 1937 the writer designed and flew the original *Westerner* gas model, which had an 8 ft. wingspan and was covered with Chinese rice paper. Through the presentation of plans for building it in May and June 1938 issues of MODEL AIRPLANE NEWS, many were built and successfully flown in this country and abroad, paper covered in every case; this covering proved ample in satisfying the requirements of even this larger-than-average sized gas model.

When it was decided to enlarge the original *Westerner* to 1½ times size in order to get a stable flying radio controlled ship with good operational qualities (producing thereby a 12 ft. wingspan), there was no particular worry as to covering material when construction was begun. However, paper in any form was eliminated at the outset, after estimating the increased stresses due to scale effect. Incidentally the flying weight, less radio equipment, is 15 lbs. The disadvantage of doped silk which becomes brittle with age was known; the heavier cotton or linen fabrics were out of the question due to excess weight on a ship of this size and areas (approx. 32 sq. ft. of covering in wing alone).

As construction of the *Westerner Sr.* neared completion the thought of *Nylon* suddenly occurred, and with a little negotiating a few parachute scraps were acquired (new fabric from chute manufacturing) for the job. Here was the perfect answer! In tests, using the fingers alone, it could not be torn or ripped in the undoped form to any extent whatever. The tendency to rip, after being treated with dope, is increased only slightly. In weather tests it would not mildew or dry-rot, due to its plastic base. The weight (parachute grade) was found to be only .159 oz. per sq. ft., which is light indeed when the strength-to-weight ratio is considered. Upon testing *Nylon's*

(Turn to page 48)



The ship in these two illustrations is a 1½ size *Westerner* (plans of the original in MAN June 1938) with 12 ft. span; note smoothness of the covering, which also affords many other advantages



ARISTO-CRAFT

READ THIS LIST!

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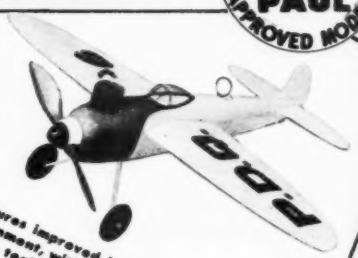
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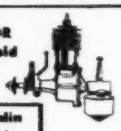


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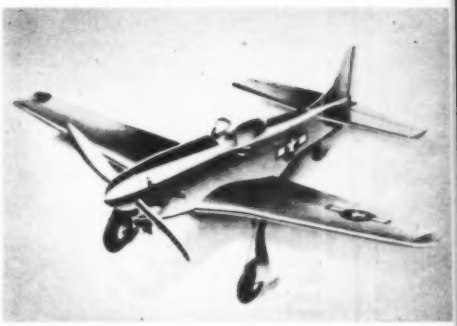


Scale 1" = 1'

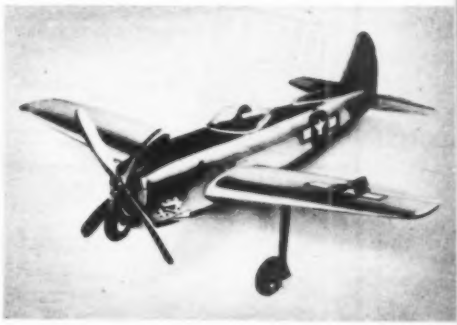
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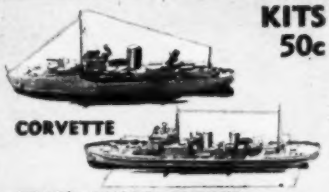
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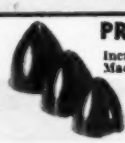
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Design Forum

(*Continued from page 16*)

These have the tail surfaces forward of the main lifting surfaces. In other words, they are a tail-first airplane allowing a jet opening at rear of the fuselage which will be free and clear of any part of the structure. Center of pressure of such an airplane is well toward the rear so that the major weights may be placed toward the rear, thus allowing a convenient placement of the heavy jet power unit.

This trend of thought seemed to be contagious and was taken up by other designers not interested in jet power. They began to wonder if Canard airplanes did not have some virtues even when powered with the normal gas engine driving propellers. So thoughts of full scale designers belatedly turned into channels that ingenius model builders have been exploring for a number of years. In fact, some years ago the standard type of contest model was the Canard pusher, commonly known as the Twin pusher.

As a result of this general trend of thought, model builders are thinking again in terms of Canards.

LeRoy Bitters of Fresno, Calif., is one of these and has sent us a design of his dream ship employing the Canard principle. A layout of this ship is shown at the head of this article and he requests our criticism of this design. Although Canards are radically different from tractors in appearance, they must adhere to certain basic aerodynamic principles common to all airplanes. First, there must be a balance between all forces acting on the plane, such as lift, weight, thrust and drag. The surfaces and thrust line must be placed in such positions and at such angles relative to the rest of the structure that the forces are in balance in all attitudes of flight. This is the first consideration in laying out the design and requires a complete force analysis.

Many embryo designers, of course, have not the experience to carry out this requirement in careful mathematical detail. They must resort to approximations, and this of course must be the result of past experience unless complete and accurate calculations are made. There is another general rule, however, which is very important and needs no mathematical consideration. That is—weights must be centralized in order to reduce the structure required for sufficient maneuverability and control. If weights are distributed throughout the fuselage length, for instance, larger stabilizing and control surfaces such as fins, forward wing, rudders and elevators are necessary. This adds to the weight and is therefore detrimental. In some cases it is even impossible to attain sufficient control and stability regardless of size of these surfaces when weights are decentralized.

These two rules are especially pertinent in the design of pushers because this type of airplane encourages decentralization of weights and involves an unfamiliar, as well as comparatively complicated force setup. Keeping these basic facts in mind, let us examine Mr. Bitters' design and see how it measures up to requirements.

Examine the side view. The engine is located directly over the main wing so that its weight is well to the rear. The weight of the wing is considerable in itself so an estimation of the center of gravity indicates its location to be approximately at the point shown in the diagram, when considering these and the

(*Turn to page 40*)

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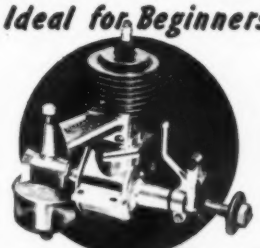


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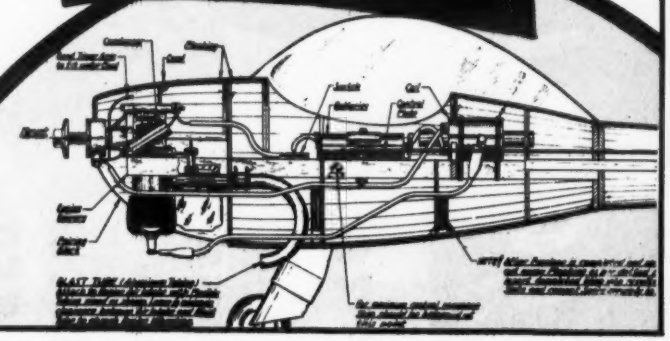
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weight of the fuselage, pilot and crew.

There is a general rule in the design of pushers which states that the c.g. should be approximately one-fourth the distance between the center of lift of the rear wing and front wing, forward of the center of lift of the rear wing. This appears complicated but is really quite simple. In this case take the distance of the center of lift of the forward and rear wings. Measure one-fourth of this distance forward from center of lift of the rear wing and you will have the approximately correct position of the c.g. of any pusher.

Now compare the position of the c.g. on the drawing with this ruling. You will note that the drawing c.g. is slightly forward of the correct position. To move the c.g. rearward and correct this condition—what is necessary? Obviously weights must be moved toward the rear of the airplane. Consideration will show that this actually will improve the airplane. The most efficient way to accomplish this is to shorten the nose, moving the pilot compartment rearward, thereby shortening and reducing the weight of the fuselage.

One of the important considerations in a pusher is directional stability. If the center of side area is forward of c.g. the ship will crab through the air, the rear swinging from side to side. As designed, this airplane would act in this manner because there is too much fuselage side area forward of the c.g. Shortening the fuselage as suggested previously will help correct this condition. The fuselage nose should come approximately at a point rearward of its present position and vertically above the present position of the wheel. This can be accomplished without interfering with the vision of the pilot or bombardier through the lower window and would make the airplane more compact without waste of fuselage space.

Now what of the second requirement? Here we see that the weights are about as far from c.g. as possible and are not centralized, as they should be. Shortening the nose as suggested will help correct this condition too, because it will bring the weight of the crew and center of weight of the fuselage more to the rear. Weights can be even more centralized if the wings are swept back instead of forward. This will bring the center of pressure more to the rear and consequently will require that the c.g. be moved rearward. However it will result in the weight of the wings and engine being closer to the c.g., which is beneficial. Then, to retain balance of the airplane the nose must be shortened still more. In this case the point of the nose would be only slightly forward of the wing leading edge. However, with the forward wing swept back instead of forward the pilot compartment would be placed above the forward wing and the bombardier's position below it without impairment of vision.

With these changes we have an airplane with the fuselage reduced approximately 25% in length, the weights much more centralized, the center of side area to the rear of the c.g. so that it is not only more stable, more controllable, but is lighter and will therefore give improved performance.

In the front view you will note that the dihedral of the front wing is about twice as large as the main wing. This is another ruling that should be followed in pushers; not only in the design of models but also of full scale airplanes. It provides stability that cannot be obtained in any other way; not only directional and lateral stability but also longitudinal. It has the effect when an airplane stalls of spill-

ing the air out of the forward wing so that the lift of this wing decreases relative to the lift of the rear wing. This causes the center of pressure of the two wing combination to move rearward, thereby reducing the stall and allowing the airplane to recover its normal flight position.

We have taken the liberty of changing the dihedral of the front wing to illustrate the correct position. In Mr. Bitters' original design the dihedral was the same on the front wing as on the rear.

On the whole Mr. Bitters has shown considerable originality and genius in this arrangement. He has given considerable attention to the details such as trim tabs, cannon, flaps, etc. These details are interesting but are very unimportant relative to the basic design of the airplane. They are classed as accessories. It is always wise to have the design of your plane prepared in the first place before considering the minor details. He has also shown excellent judgment in the general layout of his plane in respect to the c.g. position because it is nearly impossible to determine this position accurately without long experience or intricate calculation.

He has shown knowledge of some requirements in placing the radiator close to the engine, the gas tank approximately at the c.g., and in equipping this ship with a large rearward fin it is indicated that he has realized the necessity of the center of side area being located well to the rear. His only error in this respect was in estimating the relative position of this area and the c.g.

* *

Mr. John Roebuck, Jr., submits a design for an unusual light commercial plane for which plans are shown on the first page of this article. It shows understanding of basic design requirements. First, it has a high wing with the c.g. below the center of lift, thus providing a pendulum effect and increased stability. The power plant is placed high at, or slightly above, the center of drag which tends to increase speed. It is placed to the rear using a pusher propeller so that it is out of the way of passengers and ground crew. This propeller location also allows the fuselage to be brought close to the ground, thereby insuring a short and light landing gear. This feature also allows convenient accessibility to the cabin.

Oil from the engine and the slip stream of the propeller are to the rear of the passenger compartment. This obviously adds to the comfort of the passengers. The V stabilizer is the unique feature. This usually decreases lift of the stabilizer when the plane nears the stalling point. Actually the stabilizer itself begins to spill out the air in a stall, thereby reducing the whip stalling effect prevalent when the c.g. is forward of the center of pressure, as in present airplanes. The same effect may be produced, however, by equipping the ship with a lifting stabilizer so that the c.g. may be moved rearward to a point directly under or slightly back of the center of pressure. This has long been a practice in models but at present is prohibited by the Department of Commerce, a ruling which should be changed. Contrary to their opinion, such a force setup does not increase the instability of an airplane when other factors are properly proportioned.

Mr. Roebuck has taken the necessary precautions required in such a case, namely—enlarged tail surfaces. It will be noted that the stabilizer area is much larger than on the average commercial planes. In other words, this is necessary when V tails are used or when the c.g.

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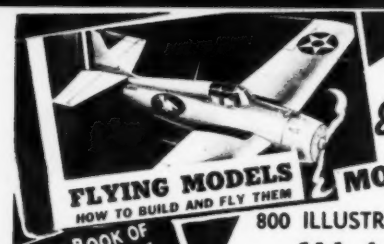
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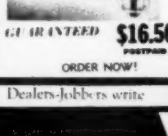
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is at or rearward of the center of pressure.

The most unique feature of this plane is the manner of control. It has a hinged wing which rotates about a horizontal axis so that the angle of incidence of both wings, or of either one separately, can be changed. This makes elevators, ailerons and rudder unnecessary. To climb, the pilot pulls back on the stick, thereby increasing the wing angle. To nose over the wing angle is decreased. This causes a change in the angle between the wing and the tail surfaces and the same effect as raising or lowering the elevators.

Lateral control is obtained by pulling down one wing more than the other. For turning, the angle of one wing is increased so that the airplane banks, which in turn causes it to circle. In landing, the angle of both wings is increased to give maximum lift. The flaps also are used to reduce landing speed. When on the ground, breaking effect is obtained by turning the wings so that they are vertical, presenting the greatest area to forward motion.

The changeable angle wings also provide another advantage. They make it unnecessary to depress the tail of the airplane for landing; instead the wings are depressed, making it possible to build the body and tail comparatively close to the ground so that the cabin can be entered conveniently and the landing gear is short.

You will note in orthodox planes with propellers in the front and rigid wings that the tail must be lowered when landing in order to obtain maximum wing lifting angle. (Approximately 16°.)

There are few if any improvements that can be made in this design. We note that the drawing does not indicate clean streamlining in the rear part of the fuselage. Possibly Mr. Roebuck has a neat arrangement in mind but does not show it. Though this type of wing has many virtues it also has drawbacks. First, a very heavy and rigid mechanism would be required to give the wings sufficient strength at the fuselage to withstand all the wing forces. This would not only add to the weight but would add to the pressure on the controls required to operate the wing. In fact, the inertias of the wing with the variation of the lift forces acting upon it would put great pressure on the controls. We believe this would result in pilot fatigue after but a short flight.

Ease of control of any airplane is most essential. Very little pressure should be required on the stick to maneuver the plane. In this case the result probably would be similar to steering a freight car. This one feature in itself is sufficient to eliminate all the virtues provided by this type of wing especially as its main feature, the increase in angle of attack at landing, may be obtained by using a high lift flap. There are flaps which increase the angle of attack of the wing as much as 24°, so in order to obtain the maximum lift angle it is necessary to raise the nose of the airplane only 4° more. Consequently, a short landing gear can be used with the body close to the ground as in this case. Mr. Roebuck's work, however, shows considerable knowledge of airplane design and is commendable because of its progressive trend. It is possible that ease of control of such a wing may be attained by means not at present known.

Don't forget to send in your original designs for discussion. Also, many readers are interested in models. Model designs, therefore, are very acceptable.

Control Line

(Continued from page 27)

6412—the former being finally used.

Measurements of tail moment, area of vertical and horizontal tail surfaces, location of thrust line, and to a lesser extent position of c.g., are all empirical design factors determined from accepted past practice (rule of thumb) which the perfectionist airmodeler, lacking a wind tunnel, later brings to an ultimate degree of precision by the good old-fashioned cut-and-try method. The measurements and areas of the *Fury III* are shown on the 3-view.

CONSTRUCTION—In order of preference the four main types of fuselage construction are: sheet covered monocoque, planked, standard (gas model) former and stringer construction, and the "hollow log" type. The stressed skin fuselage must be designed to eliminate all compound curvatures, but to accomplish this without the fuselage looking stiff or ungainly requires much careful thought and judgment. It is amazingly strong and comparatively light, however, and thus well worth the extra work involved. The planked construction is generally about equal to sheet covering but is somewhat weightier due to the number of coats of heavy filler material necessary to hide all the seams. Lightness is the most important feature of former and stringer construction; it is fairly strong and would be ideal if we had not become accustomed to admiring the sleek all metal fuselages of full size aircraft, compared to which the paper covered stringers look archaic. The hollowed out solid balsa fuselage is usually too heavy and forces the wing loading beyond its ideal limit, but it is strongest of all, allows the designer complete freedom of contour expression and is the quickest and surest way of achieving the desired shape with the least effort.

All flying surfaces should be built up in standard free flight style using rock hard material or by using lighter grade balsa ribs and spars with 1/32 in. sheet skin over the entire surface. The latter method is stronger, gives an accurate profile and adds little if any weight.

Undercarriages should be amply strong and anchored solidly—⅛ in. or 5/32 in. music wire is best. The wheels should be capable of absorbing landing shocks and must usually be somewhat larger than strict fidelity to scale would warrant. Engine cowling prevents a racing motor from overheating, but would be better left off entirely if not properly designed to surround the cylinder with a high velocity blast of cooling air.

FLYING—All that was said in Part I regarding test flying of trainers applies also to the faster ships, but adjustments must be made with even greater care and hurrying the procedure inevitably results in disaster. Assuming the ship has been properly trimmed, c.g. exactly right, elevator movement just perfect, and all mechanical parts—i.e., motor, control mechanism, hinges, switches, etc.—operating smoothly, the pilot is ready to dazzle the spectators with some really fancy flying. Not too fancy at first of course; it takes time and practice to be perfectly prepared for that coming day when the pilot feels he is ready to do his first loop.

O.K.! let's go out and try . . . 80 ft. of line untangled and connected . . . start the motor, adjust for maximum revs . . . open up the needle valve 1/2 a turn—you need a rich mixture to counteract leaning-out by the centrifugal force in a loop . . . grab the stick, signal helper for the



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takeoff . . . we're airborne and going like a bat out of you know where . . . try a sharp climb and level off . . . beautiful! . . . now bring her up to 6 ft. altitude and level off . . . steady!—pull back gradually for a steep climb . . . she's almost vertical —pull back all the way . . . over-over . . . she's on her back . . . keep stepping back to maintain line tension and gradually bring controls to neutral . . . level off again and bring her in . . . nice work!

The only thing wrong with this little imaginary interlude is that it sounds too easy. It is not! The pilot must be thoroughly familiar with every little idiosyncracy of his ship, he must spend many flying hours (really minutes) practicing the ordinary dives and climbs, diving in and levelling out smoothly, precision landings and flying over imaginary or real obstacles, such as 2 to 4 ft. lengths of 1/4 in. sq. soft balsa stuck in the flight path, bursting balloons moored at varying heights above the ground, and many other tests of skill the imaginative pilot can think up. Only then is he proficient enough to master an ordinary loop, let alone an outside loop.***

Perhaps the reader will eventually build a ship for the speed record—that's fine, but not, it is hoped, before he has enjoyed the two phases of control line flying described in these articles. It is certain that there are thrills and pleasure ahead for the pilot who learns to walk before he tries to run.—*Happy Landings!*

***When the reader manages this, the writer will freely admit that the student has outclassed the teacher.

West Coast Tips

(*Continued from page* 10)

The contest at Santa Ana was by far the most successful of the day, not only for the contestants but also for those poor maligned spectators who always wait hours while some "hot rock" fan makes "last-minute" adjustments, or some precision lad with a quart bottle for a gas tank fools around.

The first five winners were: (1) Beautiful *Vega* by Bill Givens of Burbank; (2) Great Lakes Trainer by John E. Shields of Lockheed; (3) Believe-it-or-not All Metal *P-47D* by Capt. T. E. Lee of Douglas (El Segundo), and (4) and (5) respectively, two more gorgeous *Vegas* by Bob Palmer and Ed Tifft of Burbank and Glendale.

Bob Palmer's ship was such a good flyer that although the judges of the scale event said his door was placed wrong (p.s.—the judge admitted later he really didn't know because so many different models of *Vegas* were manufactured), he went out and won the Precision flying event against "goats" and also many stick jobs, thus proving our contention that a *good* scale job is worth two "goats."

Along this idea of flying scale, we attended the Los Angeles Aeromodelers meeting at Echo Park in Los Angeles, Thursday, Jan. 10, for their first official meeting of 1946. Now this particular club is definitely an outfit that *hustles*, or as my former colleagues in khaki used to say, "Huba Huba." They have an active membership in the neighborhood of 100 citizens, and together with their inter-club affiliations around Los Angeles wield a mighty weight in model building circles all through southern California.

At this time the older members who have been away for the past three or four years doing you know what are coming back to the fold and are bringing ideas with them that they have kept alive for years. The most important proposal is

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so sound in structure that it is submitted for the interest of all concerned. It is proposed that a scale or semi-scale free flight contest be held with the following limitations of flight:

(a) A 14-oz. wing loading be used.
(b) Any type of motor to be used (no classes).
(c) A 20-sec. motor run.

Simple isn't it? The advocators of these rules say that with a wing loading as high as 14 ozs., thermals will not bother their planes, thus saving wear and tear on modelers and models.

Another thing. Did you ever see a beautiful model of a Fairchild 24 started up on a gusty March day, turned into the wind and take off slowly and gracefully and then see it catch a gust of wind,



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go through it steadily climbing until the motor quit, and then glide slowly down in a slight bank and land only a few feet from where the builder let it go? Well we did, once, and it was very impressive especially when all the endurance jobs with superstability and superclimb were cracking up right and left or getting lost in the breeze.

Now, fellows, don't get us wrong, we still like to see these graceful efficient soaring flights that are being turned in for record trials; but think of all the boys and men who put their models and tools away when airplane models stopped looking like airplanes. With the war over and lots of new motors and better-than-ever kits on the market, it is time to get the sport active again for the oldtimers and those new boys back from the war who are so airminded now.

It would be necessary to have quite a bit of advance knowledge of the contest because the scale model usually takes quite a bit longer to build than a super-duper Pylon job, but the results should be very interesting. For you club members that are desirous of increasing interest this type of contest is ideal.

Last Minute Notes! Dick McCoy's race car engine which holds world's records for spur gear is being looked at by a large West Coast manufacturer. Hold your breath, men!

Menasco is entering the small engine field with what "hears" to be a very hot engine for Class C. More dope later (hush-hush)! This engine according to reliable sources has a power curve peak at 16,000 rpm. (Note to the Editor—Sixteen thousand rpm with a ten-inch dia., ten-inch pitch prop.)

If we just hang on, fellows, the sky should be the limit on the quality of merchandise that your dealer has on his shelf.

See you next month . . .

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Page 2 *Above*—Otto Menge
Below—Press Assoc.
15 *All*—Harold G. Martin
23 *All*—Robert Hare

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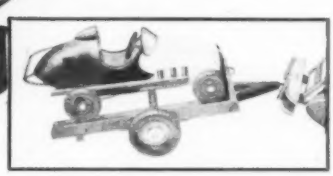


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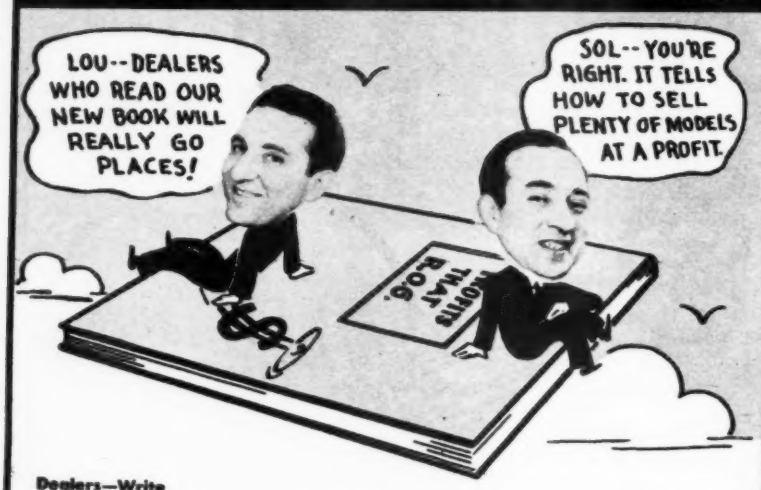
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Plane Drafting

(*Continued from page 22*)

on the vertical center plane, which in turn is designated as buttock line zero. Refer to Fig. 2. From this illustration, the front and rear half views of the fuselage have been shown in proper relation. Note the station planes and how a projection of these planes from the side view onto the plan view shows the relation to the half breadth line. The upper and lower contour lines designate the maximum height and depth dimensions for the fuselage. In accordance with the requirements of a low drag, the upper and lower contour lines are faired and exhibit no abrupt change in direction of the line unless it is accomplished gradually.

The function of the half breadth line is to show the maximum width of the fuselage. Refer to Fig. 3. In this illustration, the maximum half breadth is shown on the plan view and is also shown on the left side view in proper relation. The maximum half breadth line is not necessarily a horizontal plane, but it may be curved or somewhat irregular as a function of the upper and lower contours of the model airplane fuselage. The amount of variation of the maximum half breadth above or below the horizontal centerline plane is a function of the design of the model airplane fuselage. The amount of variation above or below the horizontal centerline plane (waterline zero) is given in a table of offsets at the major transverse station planes.

FAIRING OF CIRCULAR CROSS-SECTION FUSELAGE—Again refer to Fig. 2. In this illustration the model airplane fuselage was shown as being symmetrical about the vertical center plane and the horizontal center plane. Note that because of the symmetrical upper and lower contours, the maximum half breadth line is the same as the upper and lower contours. The half breadth line functions as the centerline for the radii from which the transverse station planes are developed. In order to obtain a properly faired circular fuselage, great accuracy must be maintained to make certain that each circular structural member at the station planes is located properly in the assembly jig.

FAIRING OF AN ELLIPTICAL CROSSECTION FUSELAGE—Again refer to Fig. 3. In this illustration is shown a typical example of an elliptical crossection fuselage. When developing the fairing for this kind of fuselage, the upper and lower contours must be drawn first. The various transverse station planes are then located in accordance with the function of the structural design. After these preliminary operations have been performed, the plan view should be drawn in order to determine the maximum half breadth line running from fore to aft on the left side view of the fuselage. After the half breadth line has been drawn, locate the position of the half breadth line at each station point by means of a table of offsets. While the upper, lower and half breadth lines may appear to be similar, do not assume that these lines originate from the same family of curves. As a result of this assumption it is possible that an elliptical fuselage may not be faired properly. In an elliptical crossection fuselage, the importance for accuracy when locating structural members at the transverse station planes (station points) is evident if proper fair lines are to be preserved in the assembly jig. Note the development of a typical elliptical crossection fuselage and the associated nomenclature. This method of development of the elliptical transverse

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plane should be undertaken at each station point from fore to aft on the model airplane fuselage. The drawing of the transverse plane of the fuselage is self-explanatory, including the method of constructing the ellipse. By means of the half breadth line superimposed upon the grouped transverse plane, a method of checking is possible.

RELATIONSHIP OF WATERLINES, BUTTOCK LINES AND TRANSVERSE PLANES—Actually, the previous discussion in this article deals with the elements of simple lofting as a function of descriptive geometry. The relationship between the waterlines, buttock lines and transverse planes is that of major cutting planes, all normal to each other. By means of measurements taken from the developments of these planes on flat surfaces of drawings it is possible to construct templates which will make it easier to construct accurately faired fuselages or wing parts for model airplanes. The general shape of the fuselage or wing is a function of the intended performance of the model plane in the air. With the advent of gas engines as the source of power for model planes, performance is a function of the parts, and the form of each part, and certain methods used in full scale design may be advantageously used. Proper use of descriptive geometry in the design parts of a gas engined model airplane will cause a reduction in drag and an increase in performance for the same power output. The aerodynamic performance of a model plane is a function of the geometrical relationship of the various parts and contours. The angle of the wing in respect to that of the centerline of the fuselage is a precision relationship. If these geometrical relationships are properly maintained improved aerodynamic performance is possible. Fairing and its associated terms apply to lines. A fair line is a continuous curve without any abrupt change being evident in direction. In model airplane design the fair lines of the fuselage should have uniform curved lines extending fore to aft with the required contraction toward the aft end, all exterior surfaces being faired.

The reader should note that the buttock lines make it possible to develop the longitudinal contours of the fuselage when used in conjunction with the waterlines which also make it possible to determine the contours in the longitudinal planes. The transverse station planes determine the contour lines at specific locations along the longitudinal axis. By proper coordination it is possible to develop on a flat surface the contours of a model airplane fuselage and from these developments to construct a model airplane fuselage accurately.

CONCLUSION—Descriptive geometry while seeming somewhat superfluous to the average model builder has been used successfully on full scale aircraft. There are no better methods for model use where real accuracy is desired. In general, descriptive geometry is useful in the following assemblies:

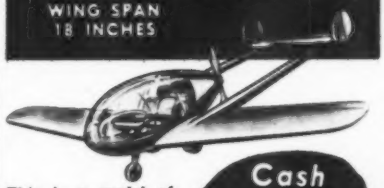
a. Fuselage contours
b. Transverse bulkheads
c. Nacelle contours
d. Floats and hulls
e. Wing tip contours
f. Fillets

These parts are always difficult to construct properly on large model airplanes, but with the assistance of good engineering design much of the tedious work will be simplified. The progress of development of the design of a model airplane has reached the pinnacle of perfection

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only where accuracy in detail design was evident. Unless accuracy is undertaken on a scale comparable to that used in building a full scale airplane, the performance of the model airplane will be handicapped. Appearance will also be displeasing to those with a critical eye for lines and detail design. Model airplane design can be definitely improved if the fundamental principles of descriptive geometry are used. That is at least half the fun of modeling.

THE END

Know Nylon

(*Continued from page* 34)

inflammability, it was found that it burns (or melts, actually) very slowly, without flame, and with little or no smoke. Even when treated with inflammable dope, the burning rate is much retarded as compared with conventional fabrics and papers. The next important study made was its ability to stretch, using standard dopes.

General Paint Corp. No. 6041 Clear Nitrate Dope was used, full strength, both for attaching the fabric to the structure and as the stretching agent. The lines most apparent in the fabric weave (sometimes called the "warp") should be parallel to the wing spars, fuselage, longerons, and empennage spars when attaching it to the various structural components. It might be pointed out here that *Nylon* lays down well when using the dope as the adhesive in turning edges over corners. The cloth should be pulled as tight as possible, covering fairly small panels as the work progresses, as no dependence can be put on water to preshrink it prior to regular doping; *Nylon* absorbs only a very small amount of water.

Two brush coats of clear dope were given the entire covering, allowing overnight drying between coats, as the final tautness attained with dope treated *Nylon* is somewhat slower of attainment than with conventional fabrics or papers. The first coat does not draw the material nearly as tight as the second coat, and so on. After a day or so the second coat will be found to have drawn it as taut as could be desired.

The *Westerner Sr.* is now over a year old and the covering looks as if it were applied yesterday, considering the fiber condition of the *Nylon* and paint, and the finish in general. Moreover, no noticeable warping of surfaces has occurred in this period. It seems entirely safe to predict that this particular covering is going to be in as good condition 5 years hence as it is now, barring serious crack-ups in months to come, of course. Holes in the covering caused by conflict with the usual stiff weeds and brush are practically unknown thus far.

The writer is completely sold on *Nylon* for future Class C designs, starting with his new *Pacificoaster*, to be testflown soon. As far as is known, the *Nylon* applied on this gas model in October 1944 is the pioneering attempt, and it appears entirely possible that *Nylon* will take its place as a covering for full sized airplanes in the near future, if cost is low enough.

Finally, here's just a friendly warning to you balsa bugs: don't grab any *Nylons* from the nearest female happening to have a pair. It will only cause ill feelings, and besides, that type of weave isn't desirable. With wartime restrictions lifted, this fabric in regular bolt cloth form should become available soon.

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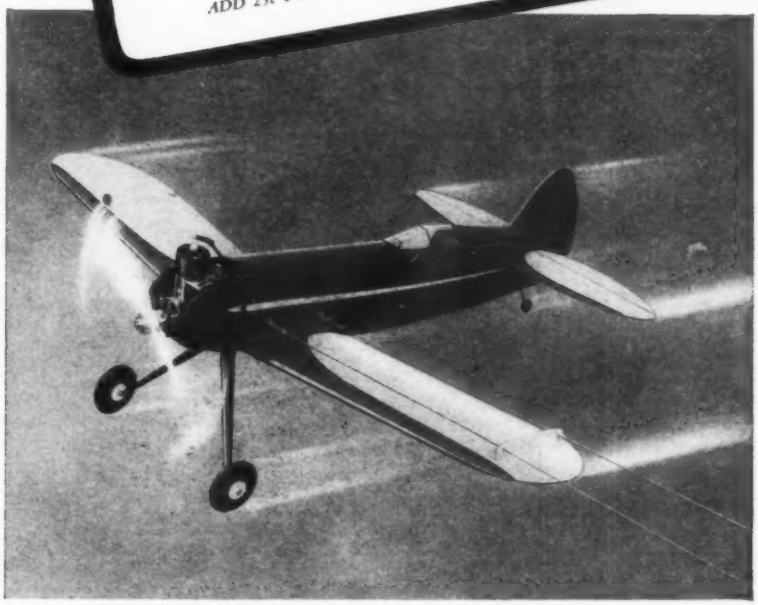
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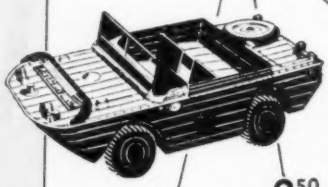
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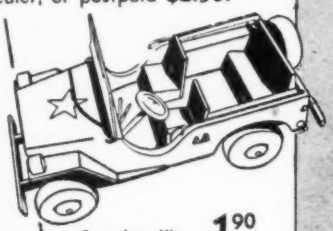


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Air Ways

(*Continued from page* 29)

turret turns and the guns can be raised or lowered automatically. The details have been scaled to look like an original *Beaufort* and the inside walls are covered with aluminum. "Longerons were added for accuracy," writes Mr. Eimert. The ship was made from pine with the fuselage hollowed out to 1/32 in. wall, and all the windows and enclosures are of moulded celluloid.

Joe Reilly of San Diego poses for No. 9 with his original creation that netted him first place in the appearance event of a recent contest. The model has a 38" wingspan and is powered with a *Dennymite*. Joe doesn't explain why he calls his ship "The Spinster" but that's his secret.

No. 10 by Bob Greenwood, 525 S. Howes, Ft. Collins, Colo., shows his ship "before and after." Too bad about the "after," but then we imagine Bob has already set about remedying the situation. Bob writes: "This ship flew very well until it got into a tussel with the wind. It is the second ship of this type that I've built although I've been a modeler for the last five years." We'd like to know if you ever did get that *Mercury* righted, Bob.

Arturo Guerra and C. Mauntua of Peru, South America, are shown in No. 11 with their Thermal Chaser built from plans in MODEL AIRPLANE NEWS. Both these fellows are members of the Jorge Chàvez Model Club in Lima and a friend of theirs, A. Yipmautin of Jeron, Azangaro 809, Lima, sent their snapshot to us for possible use. We thought you'd like to see what some of our South American friends look like, hence the picture.

CLUB NEWS

California

The E.B.A. of Oakland held a Towline Glider Contest November 18 and sent us the results: Art Wells won with an o.o.s. flight of 15:12, and Don Foote came in second with a 10:10 thermal flight.

Their indoor contest held November 5 was an ROG rubber competition with Walt Hubbard the winner of the Jr. Trophy. The other results:

(1) Jack Dyer, :58.3; (2) James Elliott, :39; (3) Bob Mallory with :31.8.

The F.G.M.A.C. of Fresno came out with these results when they held their gas model contest (free flight):

Class A—(1) Johnny Marshall, 11:36; (2) Ocie Randall, 1:43; (3) Henry Vincent, no time.
Class B—(1) Bill Dunham, 5:33; (2) Ray Balekian, 3:33; (3) Ervin Wegeman, no time.
Class C—(1) Ocie Randall, 9:44.5; (2) Dutch Van Tassell, 9:11; (3) Paul Nieto, 8:57.
Juniors—(1) Ray Balekian, 3:33; (2) Bud Warner, 1:24; (3) C. Garabedian, no time.

The Glider contest held December 9 came up with these winners:

HL—(1) Bud Warner, 2:55.3; (2) Bud Warner, 2:50; (3) M. Martin, 2:50.
Catapult—(1) R. Balekian, 4:47.5; (2) R. Balekian, 3:45; (3) Bud Warner, 3:08.
Tow-line—(1) Raymond Balekian, 13:45; (2) John Crowder, 6:49; (3) Dale Sherrill, 6:23.

And the F.G.M.A.C. Ladies Auxiliary are again holding meetings.

The Los Angeles semi-annual contest held November 18 produced these results:

Class A—(1) W. W. Scott, 11:15.5; (2) R. McLaughlin, 7:38; (3) R. Randolph, 6:35.1.
Class B—(1) H. C. Glines, 12:32; (2) Joe Menezes, 11:26; (3) J. Drobshoff, 7:43.8.
Class C—(1) Marvin Irwin, 12:25; (2) Rod James, 12:24; (3) Ed Marbut, 11:50.

Aero Modelers Association of Northern California would like all those interested in U-Control models to get in touch with Roy Mayes, 1204 Delaware St., Berkeley.

(*Turn to page* 52)



WOULDST CARVE WOOD?

You'll Find X-acto Knives "Indispensable" Says Famous Wood Sculptor

Visitors to the Open Air Art Show in New York's Washington Square last Fall were fascinated by the sight of a sculptor carving sophisticated modern figures with a small metal knife.

The sculptor was Nicholas Mocharniuk, whose work has won acclaim in galleries and art centers throughout the country. And the knife he was using was a No. 6 X-acto!

Mr. Mocharniuk uses X-acto Knives because he says, "they give the best results with the hard wood I use . . . they are especially suited to cutting away areas usually hard to get at."

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Another advantage Sculptor Mocharniuk points out about X-acto, is that he can take it with him and get in a bit of extra work while sitting on subways, trains or park benches.

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Buy where you see this sign. At better hardware, hobby and gift shops — or if not available write direct to X-acto Crescent Products Co., Inc., 440 Fourth Avenue, New York 16, N. Y.

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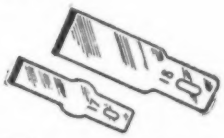
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NEW CHUCK COLLET—Grips blade even more firmly, tightens it with less pressure, gives it a longer reach.



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NEW BOOKLETS—(1) "Building Your First Flying Models". (2) "Whittling Is Easy With X-acto". Each 32-pages, illustrated, 10¢ a copy.



NEW TOOL—Small size Spokeshave for fine shaving, rounding, shaping where block plane can't reach. Solid one-piece handle, all metal and surgical steel blade. 50¢.



NEW SET—No. 85 Tool Chest, containing 3 all-metal knives, with full assortment of blades; saw; sander; stripper; planer; 2 drill holders; 10 drills; 6" steel ruler. Complete in wooden chest, $12.50.

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- What tools do they own?
- How much do they spend?
- Where do they buy?
- What models are they flying?

ETC., ETC.

This valuable data appears in a Nationwide Reader Survey made by MODEL AIRPLANE NEWS of its readership. A copy of the Survey is yours for the nominal cost of 25c each. Address

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SOME AMERICAN MOTORS IN STOCK
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Illinois

All the people who have written Donald Kraus have been asked to write to Rodger Estes, Route No. 2, Taylorville. It has something to do with the club.

Kansas

The Kiwanis Dinner Meeting held December 28 awarded certificates to boys placing first and second in events at big meets. Dick Holloway, Carl Unruh, Bob Burright, Jr. Wahl. Bill Bain, Rene Forrester, Stanley Sweney, Dean Dunlap, John Dean, and D. G. Hamilton are now the proud possessors of these certificates.

Minnesota

The St. Paul Modelers Aero Club will hold its first annual model hobby show on Sunday March 31. The show will consist of two divisions: workmanship and a flying circus. Prizes, it is hoped, will be from $500 to $1000 and many round trips to the Chicago Nationals in 1946. After all expenses are paid the club plans to buy kits to be distributed to the various hospitals in and around the Twin Cities. Everyone is invited from Wisconsin, Iowa, North and South Dakota, and of course Minnesota. For further information better write immediately to Modeleers Aero Club, 593 N. Snelling, St. Paul 4.

Nebraska

At a meeting of the Midstates Model Aeronautics Council held at Kansas City on January 6, Jack Fluehr of Omaha was named Representative from Nebraska.

New York

The Prop Spinners Club of Queens, N. Y. held its annual elections on January 9: Robert J. Mahan, president, Stewart C. Brown, vice-president, Robert J. Mahan, contest director, Wm. H. Fletcher, secretary and Henry Stumpf, treasurer. All mail should be addressed to the secretary, 8708 Grand Ave., Elmhurst, N. Y.

The Bronx Aero Club held elections and awarded three annual trophies for club points. The new officers are: John Thompson, president, William Grahame, vice-president, John E. Gluth, Jr., secretary, Paul Del Gatto, treasurer. The three trophy winners were: (1) John Thompson, (2) John E. Gluth, Jr., (3) Walter Semke. For more information write J. E. Gluth, Jr., 2620 Briggs Av., Bronx 58, N.Y.

The Hudson's Teen Age Center, 41-43 N. 7th St., Hudson, has organized a model club and all those interested in joining should contact the director.

Ohio

Garfield Heights Sky Pirates has just been formed and Siegfried Strickhauser, 5064 E. 88th St., Cleveland 5 is vice-president. It already boasts a membership of 30 with more to follow. Anyone wishing further details should write Siegfried.

The Cincinnati Jr. Birdmen Club has set May 26 for the Free-Flight, A.B.C. and U-Control, A.B.C. contests. The contest to follow will be held August 18th. Any modelers in the Cincinnati area interested in flying models should contact Jack Stoecklin, Box 436A Dry Ridge Rd., Cincinnati 31. Those control line fans are especially welcome.

England

Twickenham & District MAC, The Institute, First Crossroad, Twickenham

(*Turn to page* 54)

BACK AGAIN!

—And better than ever—

the record-breaking

PHANTOM P.30

MODEL ENGINE WITH MANY IMPROVEMENTS

Here's good news for every plane builder and model sportsman who demands a record smashing model engine. The famous PHANTOM P. 30 is back again and better than ever.

Be one of the first to own a PHANTOM P. 30—champion of champions. Note the compactness, power, precision engineering and high quality built into the P. 30. Every feature offers more advantages for your model. Here's streamlined beauty of design—and appearance—more power, less weight, outstanding performance.

This latest addition to a long line of champions which has set many world's records in the toughest competition is available NOW at this amazingly low price.

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COMPLETE WITH COIL AND CONDENSER





One-fifth horsepower; 2 intake and 2 exhaust ports; 2-cycle engine. Entirely new design. Large rotary valve and improved principle of by-passing provide approximately 20 percent more power. New, improved timer. Crankshaft, specially ground and counterbalanced, provides less vibration, greater motor speed and longer life. Clear-view, plastic gas tank with easy filler cap. Cylinder finished in gun metal. Aluminum crankcase. Sold complete with coil, tank and condenser. Every motor SOLD UNDER A FACTORY GUARANTEE.

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ANDERSON Spitfire

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The outstanding 10cc. (.61 cubic inch) semi-race engine for U-control and free flight, designed by Mel Anderson, former designer and production engineer of the Famous Super-Cyclone

Mel Anderson pledges to the model industry the finest quality engines in model aircraft history

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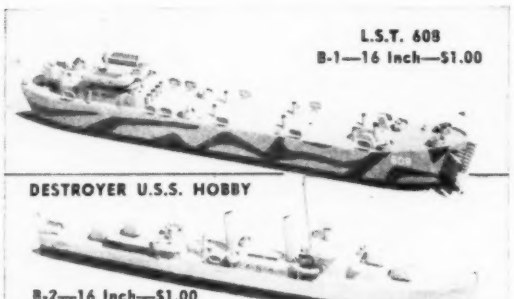
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holds meetings every Wednesday at 7:30 p.m. G. Paul, the treasurer, may be contacted for further information.

Hornchurch Model Engineering Club, Suttons Lane Secondary School, Hornchurch, Essex ask that those in the vicinity interested in modeling contact them through I. M. Leitch, treasurer.

Stockton & District MFC have celebrated their first year and ask us to tell our readers they are looking for new members. A. M. Robson is secretary, and will be glad to answer any inquiries.

NEWS FROM MODELERS

Leonard Winter, 215 Second St. East, Williston, No. Dakota wrote us to say he is 16 and anxious to contact fellow model enthusiasts through the mails.

And 13-1/2 year old Noel Edwards, 55 Haslett St., Eden Terrace C.3, Auckland, N.Z. would like people from all over the world to write him.

Frederick A. Bange, 4 Gilbert Place, Ossining, N.Y. is anxious to hear from U-control powered plane fans.

While an English friend, John G. Partington, 32 Manor Road, Ruislip, Middlesex would like to exchange ideas and have long discussions through correspondence with avid model fans.

Newsletter

(*Continued from page 6*)

We think it is high time that someone came to the defense of and gave a little publicity to that much harried individual, Mrs. Model Maker. Look at it for a moment from her angle: she marries what at first appears to be a pretty good guy. He's quiet (thinking of a new Class C design); he's on time (always first at a meet); and he drives slowly (habit picked up from searching for lost ships). But once the honeymoon is over, what happens? Why, the horrible husband starts littering up the living room with balsa shavings, he spills dope all over her new dining room table (a wedding gift from Uncle Horace—you know, the one with the bank roll!), and he leaves microfilm rings on the bathtub. What to do? Well, divorce is sometimes the answer, but in most cases the gal becomes resigned to her fate and settles down more or less apprehensively to a never-know-what-he'll-be-bringing-home-next existence as Mrs. Model Builder. She never has a home looking the way she'd like Uncle Horace to see it. So no mention in the old fellow's will.

To Mrs. Model Builder we propose a toast: she's the girl of our dreams; the apple of our eye. To her goes the real credit for many a new record; for many a new design. Without her patient help and ability to keep out of the way when the shavings start to fall and the motor starts to roar (in the kitchen), we'd be lost. It's the little girl who deserves a great big hand. How about an annual award—say, the Model Airplane News Plaque for Understanding Wives of Aeromodelers. Possession of this plaque automatically carries the privilege of her husband taking her out at least once a month and cleaning up the cellar at least once a year.

* * *

STAND BACK, MEN, we're gonna' start swinging. We are so sick and tired of hearing countless individuals make heap big talk about the "coming Air Age" that we just can't restrain ourselves any longer. What do these birds think is hap-

ACE MODEL AIRPLANE CO.

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The Nation's Oldest Hobby House at "The Hub of the Universe"

Read the ads in Model Airplane News, then write or wire. WE HAVE IT IN STOCK. NO DELAYS.

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Xacto Hobby Saw	$1.00
Xacto Pin Vise	.75
Xacto Sander	.50
Xacto Planer	1.00
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FALCON SPORTSTER



A winner . . . this U-Control Stunt plane . . . simple to build, easy to fly. Developed by Frank Greene, nationally known writer and designer. Everything included to build comic-type ship (except motor). 37" wing spread, fuselage length 26". Complete kit (less motor).....$5.95

By Mail $6.20



NEW TOPPING — 100 Control Line Sensation. Beautifully contoured aluminum completely formed for speedy assembly.

By mail $10.25 .....$10.00

All Metal Control Handle.....$1.25

Control Wire 105 Feet.....65



BLACK WIDOW

An all Balsa "Black Beauty" . . . new ½" scale solid model designed by Mair-craft in cooperation with Northrup Aircraft's own engineers. Deluxe construction, complete master plans.....$3.95

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Half Track	$1.50	Cavacraft Kit	.95
Scout Car	1.50	40 MM Anti-Aircraft Gun	2.95
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Army Searchlight	1.00	Leddy Jeep	2.50
Amphibian Truck	1.95	Stage Coach	1.50
Bulldozer	1.25	1½ Ton Truck	1.25
Amphibian Jeep	.75	2½ Ton Truck	1.25
Cavacraft P-40	1.75		

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Postage 15c per kit extra

OTHER CLEVELAND KITS

Vought Sikorsky F4U	$3.50	Lockheed Hudson	7.50
Wildcat	3.00	Westland Whirlwind	3.50
P-43	3.00	Grumman Avenger	4.00
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Airacobra	3.00	B-17	12.50
Thunderbolt	4.00	B-25	8.50
Lockheed P-58	4.00	B-26	8.50
Helldiver	3.50	A-20	8.50
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Coronet	2.50	Musketeer 54	3.75
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Playboy Jr-B	3.25	Stratospear A-B	3.25
Pacer B	4.25	Piper Cub	4.75
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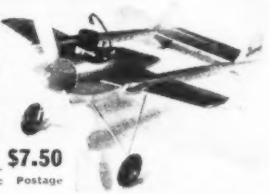
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Aero Quality Coil	$3.00
Storage Batteries 2-volt., 2.75; 3-volt.,	3.50
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No. 1 For light delicate work. With 1 blade .50c

With 6 assorted blades.

No. 2 For heavy carving. With 1 blade .50

6 assorted blades 1.00

No. 62 Two handles, all 12 blades. $2.00

No. 82. Fitted wooden chest, 5 handles, 12 blades. $3.50. No. 83 De Luxe Xacto, $5.00

A NEW COMMANDO GLIDER 42"

WACO-CG-4A Glider. All balsa. Movable controls from cabin. Nose opens, permitting Jeep to roll out of ship. Pair of skis attaches to wheels for snow flight. Complete kit $1.29.

Combination Offer:

1 Commando Glider $1.29 1 Jeep

1 Bottle Milners 35c. All for $1.98 Plus Postage .60

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Out in front in every race. Yes, the dream car of the fastest tracks . . . most completely streamlined racing car ever built. Designed and engineered by Dick McCoy. Complete with gas tank and wheels . . . just install your engine and be ready to win. Cast aluminum body, rubber tired wheels, built-in gas tank, ball bearing rear wheels, weight correctly balanced, accommodates any engine. $42.50 less motor. By mail $42.75.

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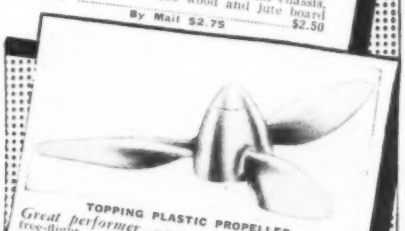
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U-Control Class B or C Gas Model with full 25" wing spread. All Balsa. Easy to construct with completely detailed plans. Complete Kit (less motor).....$5.95

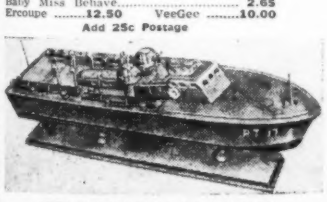
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Great performer with class C control line and free-flight models. 1-piece, 4 blade. Prop and Spinner with removable nose cap for easy attachment to engine. Precision molded of toughest plastic known. Assorted bright colors, high gloss finish.....$1.50

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Varney's Elco PT Boat	$7.95	Ideal PT Boat	2.50
Marine PT Boat	5.00	All Star PT Boat	1.50
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Add 25c Postage



CONTROLINER . . . NEW!

Sensational! Engine speed, wing flaps, elevators, all controlled. Wire landing struts, ... or ... shear pin motor mount. Complete $5.95

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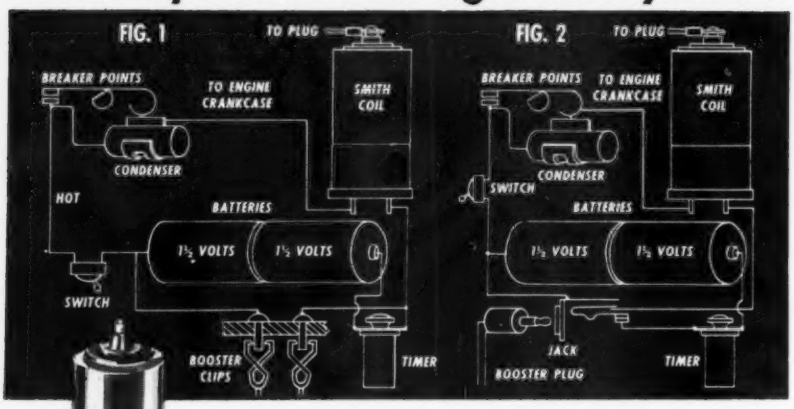
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Testor's B-29 $2.00 By mail $2.15

No Carving. Parts, wood parts, sandpaper, filler, primer and insignia. Makes beautiful model. Detailed step by step photographic instructions and assembly drawings. Ready to assemble Fully Shaped

Hook-ups for Model Ignition Systems





SMITH FIRECRACKER
$2.75

● Blueprinted above are two hook-ups for model engine ignition. And here are some valuable tips on the subject: Be sure all connections are soldered tightly. Use stranded—*not* solid—wire. Mount coil firmly so connections are easy to inspect. Keep high tension lead clear and short as possible. You'll get maximum power from your Smith coil, minimum drain on batteries.

This is the first of a series of advertisements on better *model ignition . . . For a detailed instruction leaflet, send postcard.*

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pening around them right now? Look at the airlines—carrying more passengers than ever before and turning away would-be riders by the thousands for lack of equipment. Look at flying—every surplus craft being snapped up before the ink dries on the circulars. Look at the new developments—jet transports, "coach fare" craft planned for the airlines, and, within a matter of months, all first class mail by air. Look at the schools—aviation courses in universities and secondary schools, model clubs in almost every school. Look—well, look anywhere, and it's obvious you're *now* in the Air Age. Let's stop nattering about the "coming" Air Age. While you had your mouth open, Mr. Authority, it *came*. It's here. Wake up, mate—you're late!

* * *

HATS-OFF-DEPT.: This month we award the pat of approval to an old friend of model aviation, Russell W. Nichols of Washington, D.C. Originally a Bostonian, Russ—after an eventful career which saw him in such spots as a drugstore, bank, brokerage office, automobile agency, and the government's Farm Credit Administration—finally was hoodwinked into going to work in the national offices of the Academy of Model Aeronautics.

Poor lad, then his troubles really began. Instead of being one of the mainstays of the NAA Youth Division, Russ suddenly found himself in charge of the whole set-up as staffs began vaporizing under his nose. So he has been carrying on in lone wolf style since early 1942 and is only now hoping to draw a reasonably free breath.

Nichols has been the Headquarters Director of the Academy during the war years and did a remarkably fine job—especially when you consider how short he was of help and materials. He is also director of NAA's Air Youth Division and as such has worked closely with the Boy Scouts, Girl Scouts, and other national organizations, assisting them in developing junior aviation programs.

Russ has been building models since the days when split bamboo and mother's old silk dress were the main materials in use. When he linked up with the AMA he never did have any more spare time, so his workbench is covered with cobwebs now. It breaks his heart.

Before joining the AMA, Russ organized a number of model groups, the outstanding being the Association of Model Airplane Clubs for the District of Columbia and vicinity. This was one of the most successful "combines" and resulted in some super-duper contests.

* * *

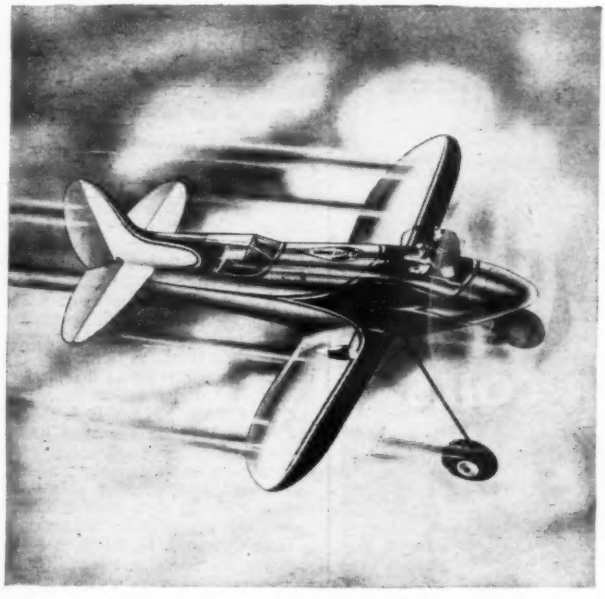
CALLING ALL rubber modelers! Here's real recognition at last. A national design competition will soon be announced by the Academy of Model Aeronautics. A little advance dope: the competition is being sponsored by Don Justice, well known designer, flyer and contest winner. Don has been working in the nation's capitol for the past few years with U.S. Weather Bureau headquarters. Now he's associated with ex-expert modeler Roy Marquardt in California working on full scale aviation test projects.

Mr. Justice feels that more emphasis should be placed on rubber modeling as a training school for gas flying. Competition is for everyone under 20 not working for a model company. Plans and photos plus performance data will be submitted to Washington; winners will be selected by a committee headed by Mr. J. He has already put up a handsome trophy; additional prizes will be announced soon.

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DESIGNED for DURABILITY...

Developed by a pioneer in control-line flying, Stanzel Super-Speedsters have consistently set the pace in performance. Designed for durability, as well as speed and easy handling, Stanzel models continue to prove themselves all-'round champions in their field. Careful selection of materials for construction kits . . . top grade balsa, hardwood and plywood, durable all-steel landing gear assemblies, streamlined wheels, the best available cement, dope, covering paper and spring steel wire . . . complete plans and instructions for building and flying . . . insure durability, easy construction and top performance. YOUR FAVORITE MODEL DEALER FEATURES THESE KITS!



STANZEL SUPER "V" SHARK

The best speed-and-stunt model for Class "B" and "C" motors, the Super "V" Shark is capable of speeds up to 120 m.p.h. The new roller control device, simple and easy to assemble, gives it perfect control and amazing stability. Its sturdiness of design and construction enables it to withstand the rigors of super speed and stunt flying.

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THE BABY "V" SHARK

Designed for Class "A" and "B" motors, the Baby Shark is ruggedly built of balsa, hardwood and plywood, with an all-steel landing gear. Its speed . . . 100 m.p.h. . . . its 20-inch wingspread, and its Stanzel Champion performance make it an ideal model for a beginner.



THE INTERCEPTOR

This Class "B" Free Flight Model, with a 52-inch wing span, possesses unusual climbing qualities. Its 350-square inches of wing area give it a remarkably flat and lingering glide, a top requisite in Free Flight planes. Simply constructed, sturdy, and easy to fly.

$2.98
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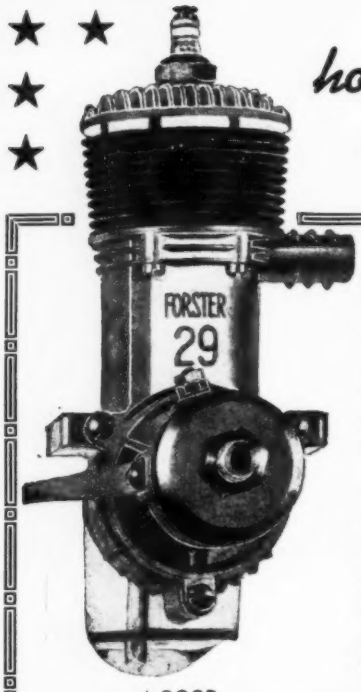
THE TIGER SHARK

Recommended particularly to enthusiasts not interested in elevator control, the Tiger Shark is a single line model, designed for Class "C" motors. It features perfect flight performance, large wing area, and simplicity of construction.

$4.95
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how much is an engine worth?



A model engine may range in price from less than ten to over seventy-five dollars, but its actual worth depends on how well it performs its intended job. This job, obviously, is to propel your model and lend it the performance you have a right to expect. When powered with the *genuine*

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you have the assurance that the price you paid represents full and honest value and that its performance will not let you down. Modern design, longer experience and pride in precision workmanship combine to bring you as fine an engine as money can buy.

Save your temper and money too! Get the *genuine* FORSTER "29" engine, the standard of quality in model engines.

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Champs must be thoroughbreds—that's why the record makers use AERO SUPER COILS! Dependable, lightning starts with 20% hotter spark, 10% less battery drain (than in our prewar high quality coils).



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Be sure you use genuine AERO SUPER COILS!

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AERO SPARK COMPANY

HICKSVILLE, L. I., N.Y.

Flash News

(Continued from page 2)

tacks started in February and March 1944 when about 200 were released and continued sporadically until November 3, 1944 when a regular release of 150 per day commenced and continued for four months. The official Japanese intelligence reports state that about 900 made the trip "effectively," but American intelligence officers have information on only 225 which actually reached the North American continent. The landing of these balloons was one of the most effectively kept secrets of the war and one of the most vital, for the Japs were held continually "in the dark" concerning their effectiveness.

THREE YEAR veterans of AAF are coming home with dreams of "settling down" on a ranch. The greatest veteran of them all, General of Army Henry H. Arnold, with 39 years of service behind him, will do just that for he announces he will "settle down" on his spacious Sonora, Calif., ranch following his retirement, expected upon his return from current South American tour. "And if any airplanes fly over," he swears, "I'll shoot 'em down!"

TWO OF THE nation's top military aircraft producers are readying personal aircraft for the bullish market now extant, both for the first time. The North American four-place model has been test flown with Ed Virgin and Bob Chilton at the controls. It is powered by a Continental 185 engine and resembles the famed *Mustang*. The Lockheed two-seat version of the *Little Dipper* is flying and will be announced soon.

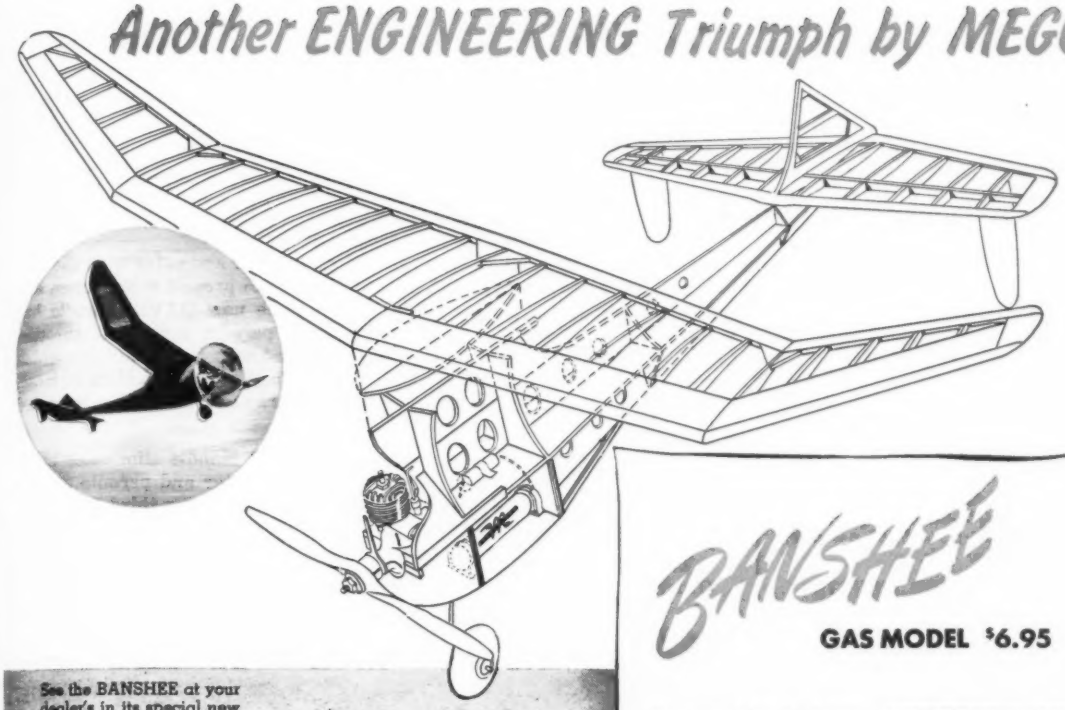
BELL HELICOPTER is now in quantity production with plans for total of 500 to be completed. To become the first commercially available helicopter, the Bell carries two people (of up to 200 lbs. each), 60 lbs. of baggage and has a range of 300 miles. It has a top speed of 120 mph and cruises at 90 mph. Bell expects the job to sell for between 4 and $5000 within two years (initial price is not yet determined but will be considerably higher than this). A new large helicopter, capable of carrying 2000 lbs. of cargo, is now under construction.

ONE OF THE MAJOR doubts concerning the helicopter has been its load-lifting capacity. Although most present day designs are considerably underpowered, the scientific basis for this doubt is a logical one. In a successful effort to disprove this argument a Sikorsky *R-5* had a field day and, in addition to breaking six world's records, succeeded in lifting 17 people (plus pilot) off the ground. Mounted on benches attached to the side of the 'copter, the young men added up to a total load of 2538 lbs. Here are the new helicopter records established by the *R-5*: (1) altitude without payload, 21,000 ft.; (2) speed without payload, 114.6 mph.; (3) speed with 500 kg load, 118 mph; (4) speed with 750 kg load, 105 mph; (5) altitude with 500 kg load, 16,000 ft., and (6) altitude with 750 kg load, 11,000 ft. Sikorsky still insists they have no plans for a commercial product!

LOCKHEED has delivered its 20,000th all-metal airplane (the Lockheed-built *Vega, Sirius, Altaire, Orion* and *Air Express* were of moulded plywood construction). The first Lockheed metal plane was the *Electra* 1001 which, after seeing service with Northwest Airlines and Mid-Continent Airlines, is still flying in Canada for Dept. of National Defense as a personnel transport.

(*Turn to page* 60)

Another ENGINEERING Triumph by MEGOW



BANSHEE

GAS MODEL $6.95



Designed by Lt. Leon Shulman and engineered by Megow. Capable of extremely fast climb, flat glides and perfect control. Experienced builders will appreciate the minimum frontal area, low wing-loading and power-loading factors so thoroughly engineered. Centers of gravity, lateral area, thrust, lift and resistance all located scientifically to work in harmony to assure smooth flight path. X-type structure requires only ⅓ the time and work of conventional types. Engine mounts accessible. Adaptable for A or B engines. Megow's Battery Holder. Finished propeller. Liberal supplies. Length 35 in. Wingspan 50 in.

See the BANSHEE at your dealer's. If he cannot supply you, send us your order and dealer's name.

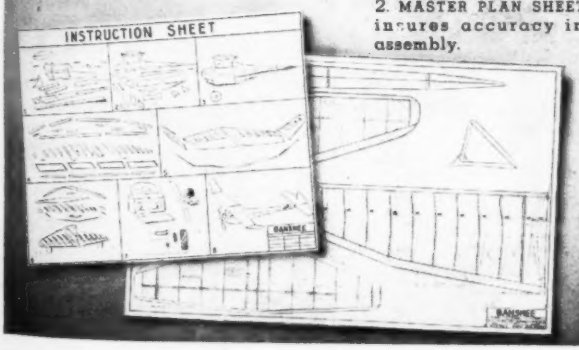
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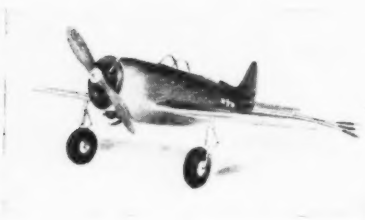
See the BANSHEE at your dealer's in its special new style box. . . . Everything safely packed in order for quick examination.



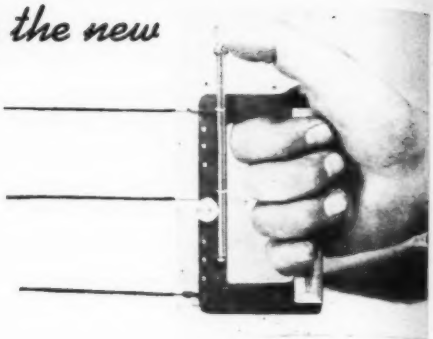
The most complete model plans ever designed for making building easy.
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2. MASTER PLAN SHEET insures accuracy in assembly.



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DAVIS ADJUSTABLE CONTROL HANDLE



YOU'LL fly your control line ships easier, better and safer with the new DAVIS Adjustable Control Handle. Designed to provide a maximum and positive adjustment of your control wires, the new DAVIS Handle has facilities for a third line. This third line permits control of throttle, switch, landing gear, etc., and may be operated with the same hand which controls the ship. There is no worry about whether it is too tight or loose. Comes complete with bell crank and all attachments necessary for third line control.

Exhaustive tests prove that the new DAVIS Handle eliminates much of the delicate "controlling" often difficult to master and permits a more varied amount of flying, yet at the same time provides a third line which in many ways can protect your ship on its landings.

The new DAVIS Adjustable Control Handle is priced at only $2.50. Order yours today.

Try These DAVIS Plane Protecting Products!

SHOCK ABSORBING LANDING GEAR

For control line and free flight planes. Price (less wheels) $2.85 per pair. Heavy duty pair for Class C ships, $3.40 per pair.

PNEUMATIC WHEELS

Permanently inflated—eliminate bouncing. Price 2½"—$1.30 per pair; 2¾"—$1.40 per pair; 3"—$1.60 per pair; 3½"—$1.80 per pair.

ADJUSTABLE MOTOR MOUNTS

Permit precision adjustment of the thrust line.
3" for Class B. 4" for Class C. Price $1.50 per pair.

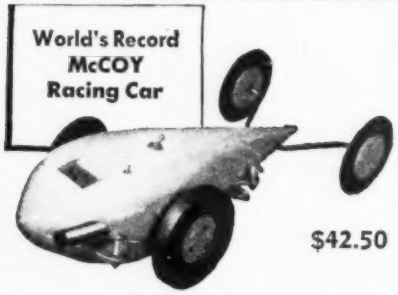
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We are proud to announce that we are the Mid-Western States distributors for the SCALE-CRAFT line of "O" and "OO" gauge model railroad kits and supplies. Dealer territories now available. Write today and operate an outstanding and profitable rail department. We also feature Picard, Varney, Mantua, A-C, Skyline, Ideal, Lehigh, Bathgate, True-Scale.

Available now . . . Ruchl's Plastic Hydroplane DEALERS: Write, wire or phone for complete details.

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IT IS UNUSUALLY interesting to receive the "final" figures on an operation, particularly one that was born with all the fanfare of a Hollywood première. The B-29 *Superfortress* program was the largest single industrial enterprise devoted to manufacture of a specific product in all history. Guided by a "B-29 Committee," this vast program was designed to smash the Japs quickly and decisively—and that job it did! Comes now the final tabulation and this includes: Boeing Seattle-Renton plants, 1050; Boeing Wichita, 1644; Bell Marietta, 663 and Martin Omaha, 531 for a total production of 3888 B-29 *Superfortress* bombers!

MOST PRACTICAL suggestion for surplus aircraft disposal yet advanced comes from Maj. C. C. Mosely, World War I flier and Pres. of Grand Central Airport Co., Glendale, Calif. Mosely believes there is a total market for surplus trainers, transports and liaison types; he suggests: "Reduce the price 10% every month until the last airplane is sold for one dollar." He firmly believes there is a market for every surplus airplane at a price. He points out that the price tag on the *BT-13* was $3800 with less than 100 sold. The price is now $690 for quantities of 3 or more and they are going like hotcats.

PROBLEM OF demobilization is a two sided one to be sure and there are legitimate, conscientious arguments on both sides. But Lieut. Gen. Carl Spaatz presents one of them neatly: Of 130,000 mechanics trained during the war only 6000 will be in service in September 1946; of 102,000 armorers, only 1500 will be left; of 101,000 radio operators trained

(*Turn to page* 62)

AULER

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HERE IS SERVICE That Insures Your Profit

COMPLETE SELECTIONS from the nation's leading model, hobby and toy lines. Over 10,000 different items are carried in stock at all times. Regular news releases on new and seasonal products offer the means for good turnover throughout the year.

PROMPT SHIPMENTS—Merchandise from stock is shipped in 24 hours. Business is confined to wholesale.

PRICES are stabilized to maintain good margin of profit to stores.

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It's 1000 to 1 you've never used a craft knife like the

"1001" Re-Blade Knife*

with interchangeable surgical steel blades!

KEEN! EVER SHARP! EVER READY!





"1001" Knife with 3 extra, different blades and honing stone, $1.59; Knife as illustrated, $1.29

Now—the first really "balanced" craft knife you've been waiting for!

Whether you're an expert craftsman or just a passably fair workman or hobbyist, you'll do *better work faster and easier with "1001"* — the re-blade knife of 1001 uses! For "1001", thanks to its light, perfectly balanced, colorful plastic handle, is second to none for easy and exact whittling, chiseling, modeling and cutting of all sorts. *Its patented, scientifically designed chromium finish blade holder simplifies the insertion and removal of "1001's" all-purpose blades, and keeps them firmly locked in place.* Which explains in large part why so many thousands of hobbyists, craftsmen, photographers, artists, home makers etc., are singing "1001's" praises! Yourself — get a "1001" — *feel* the difference, *see* the difference in your work. It's as easy to handle as a pen or pencil.

"1001" KNIFE BLADES ARE MADE OF FINEST SURGICAL STEEL. Different blades for different purposes — carefully tempered, precision ground. Designed to serve the most painstaking craftsman.

Buy "1001" wherever hobbycraft tools are sold. If your dealer cannot supply you, send check or money order for $1.59 (or $1.29) direct to

SOMAR SPECIALTY CORP., (Dept. M2) 630 Fifth Avenue, New York 20, N. Y.

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Falcon ALL STARS

Everything to build a CONTEST WINNER

the Sportster STUNT PLANE



$5.45

COMPLETE KIT Dry, Less Motor

the Speedster A real SPEED JOB



COMPLETE KIT (dry, less motor) $5.45

the Cadet Designed for Class B GAS ENGINE



Complete KIT DRY, LESS MOTOR $5.45

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FIRST METAL SPORT PLANE



THE MOST SENSATIONAL FLYING MODEL AIRPLANE ON THE MARKET TODAY. A GREAT STUNT AND SPORT MODEL WITH A SURPRISINGLY HIGH TOP SPEED.

DEALERS ATTENTION: SOLD THRU JOBBERS ONLY

- Free Flight or Control Line.
- Will Take Any Engine from .23 to .65 Displacement and May be Inverted or Upright.
- Lighter and Stronger than Conventional Construction.
- All Metal Parts Stamped and Preformed. Wings Made of Conventional Wood and Silkspan Construction—Cement Furnished.
- Precision Made Replacement Parts are Fully Interchangeable and Can be Purchased Separately.

DESIGNED, DEVELOPED & PROVEN BY

Air-Auto-Marine

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SEE YOUR DEALER NOW

during the war, only 961 will remain in service by that date. And he adds that he cannot give extensive training to those remaining because they would be eligible for separation before completing their course. Certainly the mighty U.S. Army Air Forces of World War II is dead, already!

A MYTH HAS been exploded regarding the first successful jet propelled airplane. Recent verification that a jet propelled Heinkel *He 178* made a successful flight in August 1939 and dozens of flights subsequently entitled it to the "first" honor and removes the aura of pioneering that surrounded the Caproni-Campini experiments, first successful flight of which did not take place until August 1940, exactly one year later. First British jet propelled flight took place on May 15, 1941, when the famed Gloster *E.28/39* went aloft with the original Whittle engine installed. First American flight was, of course, that of the Bell P-59A *Airacomet* on October 1, 1942.

IT MAY NOW be revealed that the AAF had elaborate plans for quantity production of Fisher P-75 *Eagle* pursuit plane. Not one experimental model, but a total of 12 of these big fighters was completed. Production schedules calling for 250/month had been prepared but the composite craft (*Mustang* fuselage, *Warhawk* wings, *Dauntless*, tail, *Corsair* landing gear and *Kingcobra* power plant) proved inferior to more advanced types.

AN INDEX TO scope of tomorrow's "airborne" war comes from a survey of air-delivered troops and equipment to U.S. following Victory. Latest is the "Sunset Project" for returning AAF veterans to U.S. following Victory over Japan. In less than four months "Sunset Project" returned 17,444 officers and men and 1259 aircraft from the Pacific. This is to be compared with the "White Project" which returned 73,933 officers and men and 6088 aircraft from Europe after V-E day.

FROM THIS SAME report come figures on number of heavy aircraft in the Pacific when Japs surrendered. These include 658 Boeing B-29 *Superforts*, 596 Consolidated B-24 *Liberators* and 5 Consolidated B-32 *Dominators*, on operation-all tests.

THE BRITISH have developed a device which opens parachutes automatically at a pre-determined altitude. Controlled by a barometer and clockwork device, the mechanism is so designed that should a pilot be forced to jump at 40,000 ft. the parachute would not open until he had reached 10,000 ft. Preliminary estimates show more than 30,000 Allied airmen leaped to safety via parachutes throughout the war.

JAPANESE PILOTS are still flying Japanese military aircraft! A British unit in French Indo-China employs Japanese military pilots and crews flying Japanese planes for transportation of personnel and supplies because of their familiarity with the routes and equipment. The British report the Japs are fully capable and are doing the job in a creditable, professional manner. Ground crews are capable, although slow. Many pilots still have their Kamikaze scarfs, their capture preventing their first and final missions in this elite corps!

CANADIANS ARE not the only ones due to receive Douglas DC-4's powered by Rolls-Royce *Merlin* engines. U.S. Army Air Forces has contracted for at least one of these hybrids. The Canadian versions are being built at Canadair, Ltd., in Montreal for Trans-Canada Air Lines.

(*Turn to page 64*)

Nation's Hobby Supply—Internationally Famous

WRITE TODAY FOR CORR'S NEW ILLUSTRATED CATALOG FULL OF HOBBY ITEMS ... ONLY 25c

Get on the Beam With

New Solids by HAWK



Perfection scaled; plastic propellers; all parts cut to shape; full size two-color plans—¼" scale.

TIGER CAT, $1.50. BLACK WIDOW, $1.50
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New, exact ¼" scale models
BLACK WIDOW, $3.95
NEW SENSATIONAL P-80, 50c

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WHIZZER
DeLuxe Control Model
$9.95 PLUS 10c POSTAGE

GAS KITS — FREE FLIGHT

Zombie A-B	$3.00	Topper A-B	$3.50
Ranger A-B	3.00	Playboy B	2.95
Miss Tiny A-B	3.25	Musketeer, Std.	4.95
Spook A-B	2.25	Westwind B	3.85
Varsity A-B	3.50	Pacer B	3.95
Jersey Javelin A-B	3.95	American Ace B-C	3.95
Brigadier B	2.95	Stanzel's Interceptor A-B	2.95
Winter Wog "B"	5.50	Musketeer B	3.50
Boomer A-B	2.95	Yogi B	3.95
Varsity A-B	3.50	Mercury C	5.50
Coronet A-B	2.50	Pacer C	4.95
Megows Piper Cub	6.95	Playboy, Sr.	4.95
Vagabond C	5.50	Skyvahl C	23.50
STRATO STREAK C			$ 2.50
Piper Cub Super Cruiser			10.95
Piper Cub Coupe A	1.95	Larkey B	3.50
Interceptor by Comet			3.95

NEW CONSOLIDATED SOLIDS

Flying Fortress 26"	$7.50	Wildcat 18"	2.50
Liberator B-24 27½"	6.50	Curtiss P-40, 16½" Mustang 17"	2.50
Kingfisher Float	6.50	Focke-Wulf 190 18"	2.50
Lightning P-38 20"	3.50	Hurricane	2.50
Vought Corsair 19½"	3.00	Defiance	2.50
Grumman Avenger 20½"	3.00	Airacobra P-39 17"	2.50
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Testers C54 Skymaster solid 2.50
Postage 15c per kit extra

TOPPING "100" U-CONTROL (pre-formed) ALUMINUM FLYER

Just install B or C motor and wiring, snap together the fuselage, wing and tail and she's ready to fly. **Less motor $10,** plus 25c postage.

GAS CONTROL-LINE FLYERS

Hellcat "C" $4.95; Mustang "C"	$ 4.95
P-47 Thunderbolt "Control Liner"	$ 5.95
"Ice Gee" fastest in the air; 18" span	10.00
Tether Streak, A, B or C	2.95
Super "V" Shark, B or C	4.95
Baby "V" Shark, "A" or "B"	2.95
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Falcon Speedster, B or C, all balsa	5.95
Sting Ray, B or C ... $4.75	Dura plane 19.50
Tether Sharpie ... 1.00	Dreamer, Class C 7.50
Cliff's Trainer, kit ... 3.75	Wasp 7.50
G 13 Biplane, kit ... 7.95	Hornet 7.50
American Jr., Fireball	10.00
Tarpon Control Line Speedster, redi-hollowed fuselage, Kit	10.75
Piperskycycle "U" Control—plastic canopy—many extras	7.50

Add 25c postage to above prices.

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Steel Wire, 100 ft. spools	75c
Tether Kit, by Snafu	1.00
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GLIDERS

Thermic 18"	$ .20	Condor	$1.00
Thermic 20"	.35	Imperial 72"	1.00
Thermic 50"	1.00	Thunderbird 60"	1.50
Thermic 70"	3.50	Albatross 10-ft.	3.50
Trooper 32"	.65	Sinbad 50"	1.00
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Comet's 18" Mustang			.35

MINIATURES for the COLLECTOR



Official, secret models, each finished in a minute scale 1" to 9 ft.

They'll fit in the palm of your hand. All models featuring revolving turrets and many have working wheels. You'll thrill to the possession of these precision built miniatures!

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U.K. Cruiser M.K. V	$1.35	Lt. Tank M5A1	1.35
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Tissue Paper for rubber powered, 12 for	50c
Battery Boxes, all metal, specify size	40c
Fromm Metal Gas Tanks, $1 kit	50c
Coils—Aero Featherweight, $2.50; Quality	3.00
Tail Wheels, ⅞" dia., 10c; 1⅛"	15c
Hely-Arc Rubber Wheels, 2", pair 50c; 2½" pair	60c
Power Plus Wet Cells—flight $2.75; booster, $3.50;	
Landing Gear Shock Absorbing, A or B, $2.85; C, $3.40	

WOODBURNING PENS, Each **98c**

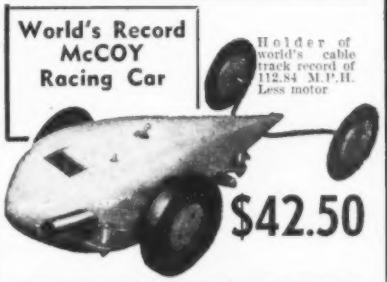
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15" scale model; fully carved hull; complete fittings.

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Holder of world's cable track record of 112.84 M.P.H. Less motor

$42.50

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LST Boat, Rogers	$1.95	Anti-Tank Gun	.40
U.S. Army Half Track	1.50	Scout Car	1.50
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Amphibian Jeep (large size)			2.75
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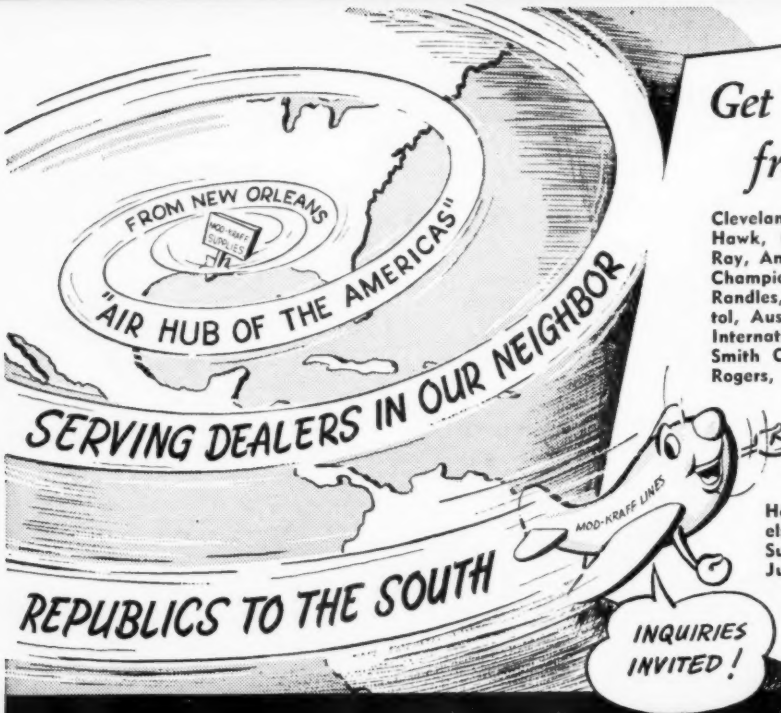
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(ESTABLISHED 1890)

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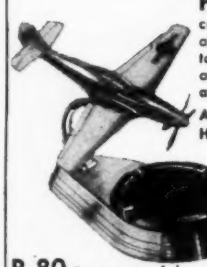
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FAMOUS FIGHTER SERIES



P-51 Perfect scale die cast model. Complete in all details, on swivel pedestal. Plastic bubble canopy and pilot. Removable glass ash tray.

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P-80 Exact scale of the Shooting Star. 8½" wing span. Plastic canopy with pilot. Wing tip tanks. Swivel pedestal. Removable glass ash tray.

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SPOILS OF WAR! The British are shipping a large number of captured German gliders to gliding clubs in the British Isles. Many more are now being used in Germany by British occupation units who have formed glider clubs.

GOOD NEWS FOR National Guard airmen comes from Maj. Gen. Lauris Norstad in outlining plans for postwar AAF and the National Guard. Gen. Norstad stated plans are being made for 80 National Guard squadrons, equipment for which will be "mostly of the fighter-bomber type." Use of fighter-bombers by Guardsmen will be a welcome relief from observation types of the past.

DATA ON ONE of the most efficient internal combustion aircraft engines yet developed has been released. The Continental I-1430 *Hyper* is a 12-cylinder "V" design used in the McDonnell *XP-67* (MODEL AIRPLANE NEWS, June 1945) fighter. It develops 2100 hp at a weight of only 1645 lbs. or approximately .78 lbs./bhp, a new low. It also develops 1.5 hp/cu. in displacement, another remarkable figure. The *Hyper* was also used to power the Lockheed *XP-49*. It was designed specifically for operation with a turbo supercharger, which produces these efficient figures.

ONE OF THE FEW pre-Victory military planes still in quantity production is Lockheed P-80 *Shooting Star* of which approximately 300 have been delivered to AAF. Current production is about 8 per day, and test flying of these *jaypee* demons has been moved from crowded Lockheed Air Terminal to Van Nuys Army Air Base nearby.

REPUBLIC XF-12 four engined, long range photo-reconnaissance monoplane has startled observers by looking in the

(*Turn to page 66*)

GET THE **MARVIN JUNIOR A NOW!**



Only $13.40

FACTORY TESTED AND GUARANTEED

Complete with coil and condenser, wired and ready to go

Bare weight: 5 oz. Displacement: .34
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The diamond bored cylinder is lapped and honed to .0001 running clearance. Minimum weight and the high compression of 7 to 1 give you maximum speed and horsepower. Needle valve type carburetor. Plastic gas tank. The fast starting MARVIN JUNIOR A is a proven champion.

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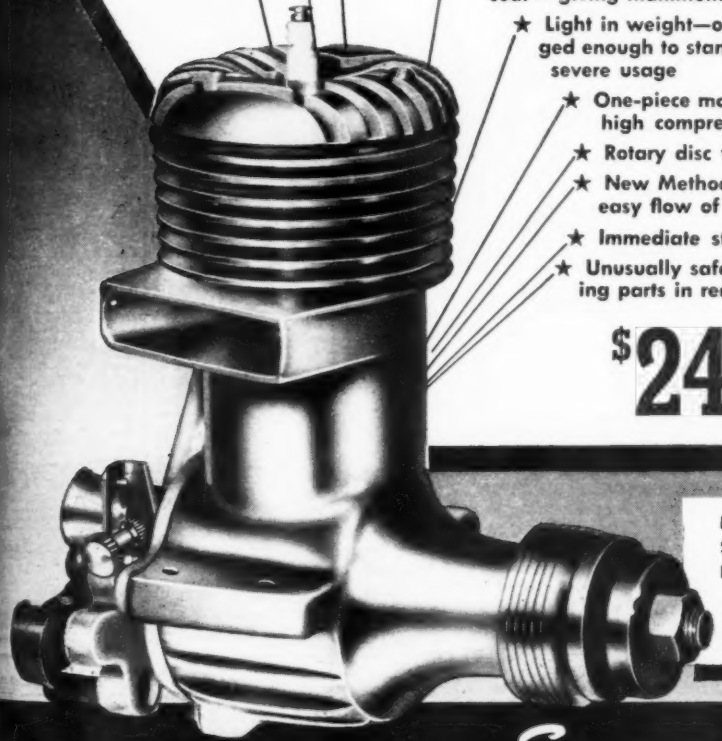
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the Pacemaker 59

Here is new Super Power for your favorite gassie whether it is control-line or free flight The PACEMAKER-59 is a new ball bearing design that is light weight and streamlined but packs the wallop you need for control-line flying. Whatever you put it in is going to be out there in front. Here are some of the features

- ★ Friction-free crankshaft mounted on ball-bearings
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- ★ New Method of porting for easy flow of gases
- ★ Immediate starting
- ★ Unusually safe to operate—all working parts in rear of engine



$24.95 less coil, condenser and tank

Bore	.930
Stroke	.875
Disp.	.594
Weight	12 oz.
R.P.M.	up to 15,000

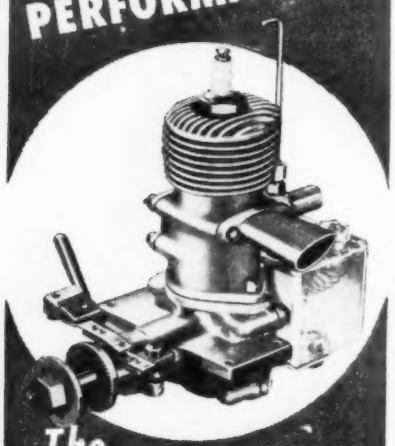
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Look to Dennymite when you want that extra reserve of power so important in contests . . when you want all 'round dependable performance that never lets you down, no matter how tough the going is. The Dennymite secret lies in engineering excellence and in the exhaustive shake-down tests given to every Dennymite engine before it reaches your hands. When you want to make a really good showing at your next important meet, put Dennymite to work for you . . . give your best model the power plant that's worthy of it. You will find Dennymite at your favorite dealer.

DENNYMITE AIRSTREAM (Motor Unit Only) . $15.85
Standard DENNYMITE AIRSTREAM Motor, $17.85
(Includes Coil, Condenser, High Tension Lead)

SPECIFICATIONS:

Bore and Stroke	.9 in.
Displacement	.57 cu. in. (Class "C")
Horsepower	.25 hp at 6500 rpm
Max. Speed Range	1,000 at 15,000 rpm
Engine Weight	9.5 oz.
Tank Capacity	⅓ oz.

DENNYMITE OWNERS
Send your engine in NOW for PRECISION overhaul. Complete stock of replacement parts on hand.

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flesh exactly like the artist sketches released before its completion. (Most of us are amazed at how far short most planes fall of their sleek and beautiful paintings advertising the coming debut!) Prototype of forthcoming *Rainbow* passenger model, the XF-12 is powered by four Pratt & Whitney R-4360 *Wasp Major* engines equipped with exhaust jets which provide 20% extra power. Span is 129 ft. 2 in., length 98 ft. 9 in. The Curtiss props are 16 ft. 2 in. in diameter and each engine has two General Electric turbo superchargers. These latter are mounted vertically to permit "axial flow" of exhaust gases into the jet pipe.

JET ENGINE contractors to AAF include Wright Aeronautical Corp., Packard Motor Car Co., Lockheed Aircraft Corp. and Northrop Aircraft, Inc. Details on their projects have not been released but rumors persist of a 10,000 lb. static thrust unit now on the way.

PROMISE of jet propulsion has been broken with revelation that a jet system does *not* provide power on up into limitless speeds. Tests indicate that at speeds of 1500 mph the gas turbine flow begins to break up through the compressor, combustion chamber and turbine. The intense heat generated by shock waves, in addition to their dynamic disadvantages, spoil the whole system and create high temperatures and pressure where they are unwanted, at the same time destroying pressures that are desired. R. P. Krone, Westinghouse chief engineer on aviation turbines, believes the jet finds its most useful application at speeds from 500 to 1500 mph, and speeds greater than this are the proper job for the rocket.

A LITTLE KNOWN but amazing fact concerning Nazi aviation development was revealed recently by technical experts examining German plants and scientists. This was the extraordinary development of power boosting system. The Germans had made astonishing progress with methanol-water, ethanol-water, pure water and nitrous oxide injection systems for use on reciprocating aircraft engines. The methanol-water injection system, for instance, increased power output of the DB-603 engine at sea level from 1800 to 2250, an increase of 450 hp! The Ta-152B, fitted with this engine, increased its speed from 417 to 438 mph by nitrous-oxide injection.

PLANS OF Dr. Jean Piccard to ascend to 100,000 ft. in a special "balloon cluster" gondola in an attempt to exceed the present 72,395 ft. altitude record had better be pushed promptly. News has come that numerous stratospheric balloon flights have been made by Russian officers from Red Army Central Aerologic Observatory. These flights, sponsored by Soviet Academy of Sciences and Moscow Lomonosov State University, have been for the purpose of studying cosmic rays in "upper strata of the atmosphere." Although no altitudes have been published, we'd better hurry up!

ASIDE FROM the now well-known use of radio control for guided missiles and other military purposes, it is coming more and more to the fore as the ideal means of testing new ships without risk to test pilots and valuable prototypes. For example, Consolidated Vultee built an exact scale flying model with about 13 ft. wingspan, and weighing 90 lbs., on which extensive tests have been made relating to the dynamic characteristics of seaplanes while landing and taking off. Powered by two 2 hp twin-cylinder engines, the little ship was an exact model of the CVAC Model 31 flyingboat.

Around the Clock Service

SUPER 60 $24
Bore 900
Stroke 950
Displ. 604
Weight (bare).....12 ozs.
With Coil, Condenser, Spark plug and Tank

VIVELL "35" - CLASS C $18.00

HANDEE GRINDER $18.50
With 6 Accessories

CANNON—"300" "38" - - - - - $19.75 $21.50

THE HORNET Class C; 60 Cu. In. less coil $35.00

SUPER-DUPER FUEL—PT. 30c
DEAN-A-FUEL — PT.....35c
HI-SPEED PERFORMANCE

HURRICANE "B" $24.95
(complete coil & cond.)

ROCKET "C" $22.50
(immediate delivery)

GAS MODELS

*P-47 Thunderbolt Controliner "C"	$5.95
Musketeer "42" "A"	2.50
Buccaneer "36" "A"	1.50
Buccaneer "48" "A" or "B"	3.50
American Ace "36" "A"	1.50
Buccaneer "C" Special "C"	6.95
Buccaneer "Standard" "C"	5.95
Skyrocket "A"	2.25
American Ace "54" "B"	3.95
Brigadier "B"	2.95
Musketeer "Standard" "C"	4.95
Buccaneer "B" Special "B" or "C"	3.95
The Larkey "B"	3.50
Coronet "A" or "B"	2.50
Aero Champ "A"	2.00
Ranger "A" or "B"	2.50
Wog "B"	4.95
Piper Cub "B"	4.50
Topper "A"	3.50
Jersey Javelin "A" or "B"	3.95
Pacer "C"	4.95
Strato Spear "A" or "B"	2.95
Pacer "B"	3.95
*Tarpon "B" or "C"	12.00
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Aero-Spark Conden.	$ .35
Paper Condenser	.20
Aero-Coil	2.50
Wilco Coil	1.95
Spark Plugs—All Types	.50
Hi-Tension Lead	.15
Ignition Wire, 5 Ft.	.15
Alligator Clips	.15
U-Control Wire (Steel)	1.00
Cyclone Needle Valve	1.50
Universal Needle Valve	1.25
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Celluloid Sheets, Small	.15
Balsa Props., 5" Diam.	.07
Gas Props. 8", 9", 10" each	.35
Flo-Torque Props., 8" to 14"-Finished Hi-Pitch	.50
Flo-Torque, semi-finished, 8", 9", 10", 11", 12", 13", 14"	.30
Plastic Spinners, 1¼ x 1¼	.75
Aluminum Spinners, 1½" $1.25, 1¾" 75c, 2" $1.50	
4-Way Plug Wrench	.17
Emery Cloth & Sand Paper, assorted per pack	.10
Dope Brushes	.25
Ohlsson 19-28, Forster '99 Exhaust Stacks	.50
Gas Model Tissue, 1 Doz.	.10
Special Skin Tissue	.10
Assort. Color Tissue	.07
Thrust Bearings, L-8	.15
S.A.E. No. 70 oil, Pt.	.35
Qt.	.60
Prop. Nuts	ea. .15
Paint Brush	(Med.) .10
Sanfo Prop. 10"	.25
X-acto Deluxe Set	5.00
Neo-Prene Tbg.	1 ft. .05
1½ volt Booster	.10
Plastic Roc. 3 oz.	.40
Model knives	.15
Wire Cutters	3.50
Gas Droppers (ideal for mixing fuel)	.20
X-acto Pin vises	.50
½" flat rubber, (80")	1.00
1/16" sq. rubber (100")	1.00
Toggle Switch	.60
Motor Bolts & Nut, 6-32	.10
Wire, 1/16" x 36"	.15
1/8" x 36"	.35
Screw Drivers	.20
Fine Files	.25
Sponge Wheels 2"-2½"	.15
3½" Diam.	.20
Penlite Cells	.10
Battery Box, lg., 6m.	.40
Metal Condenser, lg.	.40
Drill sets, No. 61 to 80	$4.50

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Dope—Thinner—Cement. Finest Quality Obtainable.
1-Oz. Dope in all colors.....$ .10
2-Oz. Dope, Thinner.....20
4-Oz. Dope, Thinner, Cement.....30
1-Pt. Dope, Thinner, Cement.....1.00
1 Gal. $6.00 ANY COLOR

BALSA SPECIALS

1/16" x 2" x 16" 40 for	$2.00
1/16" x 2" x 18" 40 for	2.50
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ENCLOSE $0.15 FOR CATALOG

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SEND CHECK, MONEY ORDER, NO C.O.D.'s. BE SURE TO PRINT ADDRESS PLAINLY. ADD 15% FOR MAILING, PACKING. NO ORDER ACCEPTED UNDER $1.00. ALL OUR SHIPMENTS RECORDED.

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Here is your Post War Engine!

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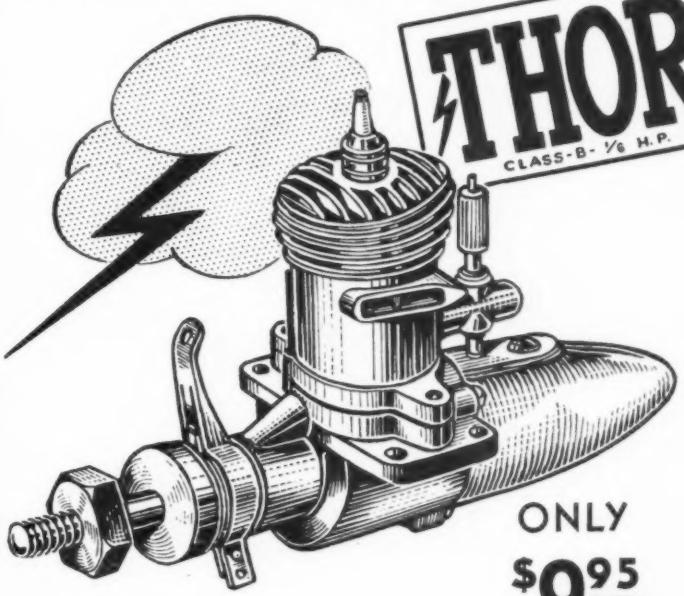
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- Perma-designed foolproof timer—never needs adjustment—can't slip in operation
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THE ENGINE FOR POWER!

Specifications

H.P.:	1/6
Bore:	13/16
Stroke:	9/16
Displacement:	.29
R.P.M.:	300-11000
Weight:	4½ oz.

Class B, NAA rules

Here is **your** engine!! Starts with a "twist of the wrist" and hums along until you stop it. And what power! Just the model for all Class "B" planes, large or small. And ideal for boats and race cars as well! Priced at only $9.95 complete with coil, condenser and fully illustrated instructions. Only our large production can give you so much value for so little.

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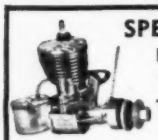
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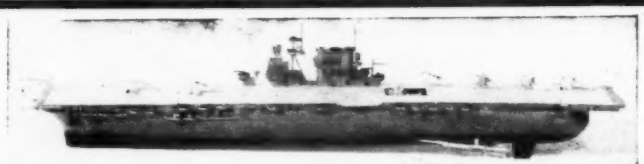
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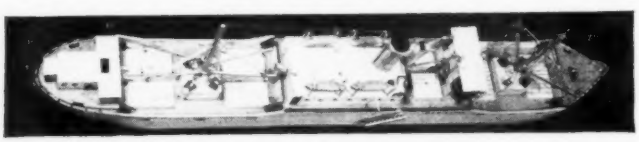


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Construction details: Hollow hull with water tight bulkheads mounted on main keel. Planked flight deck. Model completed has all scale details of the large ship including guns, life rafts, boats, three types of aircraft in miniature, etc.

Kit contains more than enough material to build model including three tubes cement, metal tubing and sheet, wire, varnish for hull and deck, paint, brush, sandpaper, blade for cutting, etc.
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37" Freighter—Top View Above



37" Freighter—Side View. All Balsa Const.

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World War I

(Continued from page 23)

Probably because it was popular at the time a wire trailing edge was employed. This was laboriously tacked to the tail of each rib by a band of very thin aluminum binding the wire in place. Rib tips were horizontally notched to receive the wire.

Center section of the *Spad 7* one-piece upper wing was plywood covered and contained the engine water expansion tank. The trailing edge at this point was cut out to the rear spar to improve the pilot's visibility upwards and to facilitate his getting in and out of the cockpit. The lower wing, made up of right- and left-hand panels, also was cut out near the fuselage to improve downward visibility.

Empennage

The familiarly angular tail fin was attached to fittings at top of the fuselage and to the rudder post and was constructed entirely of wood. Solid spruce ribs were routed on their upper and lower surfaces to form an "I" shaped cross-section. All members were glued and tacked together with free use of plywood gussets. Construction of the roughly rectangular rudder followed that of the wings, including the method of attaching the wire trailing edge.

The horizontal stabilizer was made in one piece and strut-braced to the lower longeron. Its internal construction consisted of a hinge line spar, ribs assembled exactly like those of the wings, but with a wide plywood leading edge covering both upper and lower surfaces. Elevators followed constructional details of the rudder.

Fuselage

Most complicated of all *Spad 7* structures was the fuselage. Built up of a multitude of small dimensioned members, it reflected Bechereau's attempts to obtain a light streamlined shape with the use of wood and fabric. The four longerons, for instance, were of solid spruce from the cockpit forward, but were spliced to aft longerons routed out for lightness between assembly fitting attachment points. Assembly was accomplished by use of stamped steel fittings bolted to the longerons, and conventional steel wire bracing tensioned by turnbuckles was employed. The lower longerons at point of lower wing attachment were shaped like the airfoil and thus reinforced to carry landing gear stresses. What would ordinarily constitute a firewall was cut out to receive the last few inches of the *Hispano Suiza* engine but offered little fire protection. Spanwise, the firewall was in line with the front lower wing spar and vertically was adjacent to the front center section strut fittings.

Structure forward of the firewall was a continuation of the longerons, to which were attached large steel stampings holding the two ash engine bearers. The latter were braced vertically by cut-out steel sheets riveted to the basic structure of the rounded nose. The circular radiator located in the nose was faired into the fuselage by a well developed aluminum cowl assembly attached to the framework by screws. Streamlined "bonnets" covered the forward portion of each bank of engine cylinders where they projected beyond the cowl contour and were perforated to aid in cooling the heads. Engine access doors were attached to each side of the engine cowl with quick action fasteners. Cowling on *Spads* produced in France were provided with numerous ventilation louvres, while English built *Spads* maintained unventilated

(Turn to page 70)

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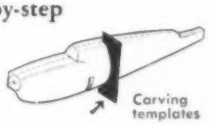

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H-7 Piper Super Cruiser


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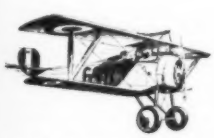

H-8 Aeronca Champion

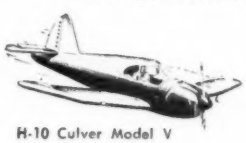

H-3 British Sopwith Camel

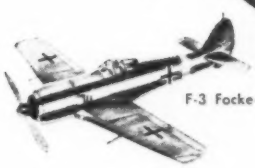

F-1 Thunderbolt


H-9 Republic Seabee


F-2 Hellcat

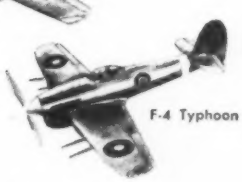

H-4 French Nieuport 17C.1


H-10 Culver Model V


F-3 Focke-Wulf


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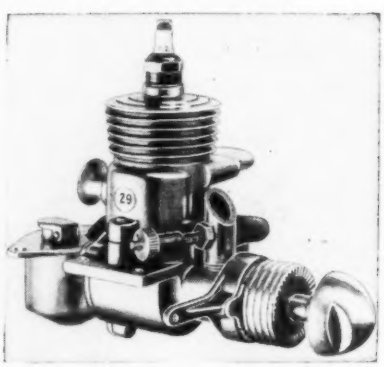
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cowls except for the section immediately underneath the engine.

Numerous plywood formers maintained the round nose shape on the fuselage top and bottom. Longitudinal stringers attached to these formers and directly to the structural uprights on the fuselage sides prevented the fabric covering from sagging.

Solid spruce landing gear struts, highly streamlined and assembled in right- and left-hand pairs, were attached by stamped steel fittings to the already mentioned heavied-up forward lower longerons. The streamlined spreader bar on French built machines carried a one piece vertically floating axle, and a two piece center-hinged axle was supplied on British constructed models. The latter had the effect of splaying the wheels outward under ground loads and was typical of many British aircraft. Rubber cord absorbed landing shocks in both cases. The structure was braced by two sets of crossed wires.

Wing Struts and Rigging

Greatest asset to the *Spad 7's* remarkable strength was its interplane bracing system. Actually the cellule was a single bay type, fitted with one pair of full gap struts to each half-panel. These full struts were spaced rather far out on the span, however, and between them and the fuselage was placed an intermediate set of half-struts in turn connected by a horizontal strut forming an upper and lower bay. Each bay carried its own tension wires while normal interplane lift and landing wires intersected and were connected to the fitting that held the horizontal strut rigid. Four center section struts, attached to fittings on the upper longerons, carried the upper wing over the fuselage. The cellule assembly was very simply put together by small steel pins which connected the various steel fittings. These pins, in turn, were safetied by ordinary domestic safety pins rather than by cotters!

Rigging the *Spad 7* for flight was a comparatively simple job, but it had to be done properly or the performance was haywire. Stagger, for instance, was 45 mm according to Bechereau's design, but it was found in service that 43 mm gave the *S-7* better level flight high speed characteristics. Additional negative incidence in the stabilizer was found to be beneficial from tests and all production *Spad 7's* were equipped with a 3/16 in. shim under the stabilizer spar. Incidence was 2 degrees throughout the upper wing and 1½ degrees throughout the lower wing. Neither wash-in nor wash-out was provided. Dihedral was zero degrees in both wings, while the ailerons drooped ¼ in. with the stick central.

The Record

There you have the *Spad S-7C.1*. How good a fighting ship was it? As far as quantities go, a shade over 5000 *Spads* of this type were constructed in France alone, where during the summer of 1917 nearly every French pursuit squadron was equipped with them. In addition, hundreds were constructed under license in England and used not only for home defense but on the British sectors of the Western Front as well. Every French fighter pilot who flew during the period from spring 1917 to November 1918 piloted the *Spad 7* in the course of his career. The list is long: Guynemer, Fonck, Madon, Coeffard, Pinsard, Haegelin, and dozens of others wrote the name of *Spad S-7C.1* over World War I battlefields in letters too big for the Germans to ignore. And those who chose to ignore that little fighter never lived to repeat their sneer.

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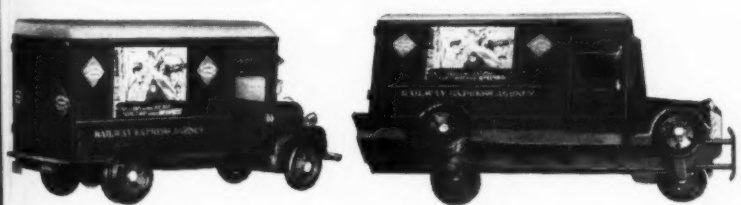
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Reynolds Number

(*Continued from page 21*)

bers and bear not the slightest relation to the figures obtained with a typical full size airplane at a *Reynolds Number* of say 3,600,000.

One can make a few generalities but that is about all. For example, it would appear that for airfoils which have what is usually considered to be a rather low $C_{l\,max}$ (such as the NACA 0006) there *may* be little change in the $C_{l\,max}$ with a decrease in *Reynolds Number*. Too, the maximum lift may tend to decrease slowly or may even increase at the lower *Reynolds Numbers* with airfoils having a high average camber. It is unfortunate that no general conclusions can be drawn as to trends but if anything, *these curves demonstrate how unpredictable the behavior of the average airfoils become as they approach low Reynolds Numbers.*

What does this all mean? Simply that you might as well forget about trying to make a contest model with an airfoil that is really the nuts on the latest light airplane. Of course it will fly but don't be disappointed if you don't win. If you do win it may be because you were luckier with a thermal—or the other contestant picked an even worse airfoil. And as for trying to adopt some of the new slick-looking so-called "laminar flow" airfoils because the P-80 or the B-42 uses them, that's even worse. Sure they'll fly on a model too—but the model will fly with a simple curved plate for an airfoil section—and probably even better.

While on the subject of "laminar flow" airfoils, you will find that many of the top notch aerodynamicists object to that term in no uncertain manner. They much prefer to call them "low drag" airfoils, and correctly so. The drag is certainly much lower than on most more conventional type of airfoils (at least in the range of *Reynolds Numbers* covered by the full sized ship), but the flow is definitely *not* laminar throughout the chord, it merely stays laminar a little farther back.

Unlike the flow past the wing of a full sized airplane where *R* ranges from well over the 1,000,000 mark to away over 30,000,000 (and in what is known as the "super-critical" range), the average free flight model is in the range of well below 100,000. In this lower range may appear what is known as a "sub-critical" state in which the lift decreases considerably and the drag increases tremendously (remember Fig. 1) under particular flow conditions. The stage at which the *R.N.* changes from sub-critical to super-critical is known as the *"Critical Reynolds Number"* and of course varies with the airfoil.

The processes in the flow past the wing are controlled almost entirely by the state of the flow in the very thin layer of air next to the wing. This layer is sometimes called the "friction layer" but termed by Prandtl (one of the earlier and better known aerodynamicists) and now almost universally known as "boundary layer." To make a long story short, there are two types of boundary layers; one "laminar" in which the particles of air move in smooth paths parallel to the wing surface; the other "turbulent" in which the particles of air in the boundary layer move in swirls or eddies along the wing surface. Involved mathematical explanations can be given as to the whys and wherefores of these two types of layers but suffice it to say that upon the condition of this boundary layer depends such things as the frictional loss, internal velocity, and thickness of the boundary layer—and most important, the capacity

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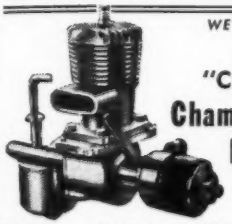
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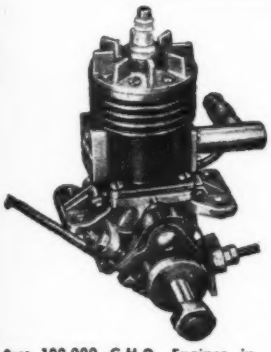
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for absorbing energy from outside flow.

In the sub-critical state, the boundary layer on the upper side of the wing tends to be laminar whereas in the super-critical state it is turbulent. Many volumes have been written on the subject of boundary layers, most of them involving complex and higher mathematics. Consequently the following explanations are greatly oversimplified and probably will not please an aerodynamicist. And now that you are forewarned:

LAMINAR BOUNDARY LAYER ON MODEL—The type of laminar boundary layer which is peculiar to the region of the small *R.N.* is very thin. It causes little frictional drag, and wing roughness which is not too coarse is smoothly covered by the layer (Fig. 3-A). But the big drawback of the laminar layer is that it is incapable of absorbing energy from the outer air stream (streamlines) which might help in pushing the particles of air along; and in spite of the low friction, the kinetic energy (inertia), which the particles possess by virtue of the motion of the wing through the air, is quickly lost. The net result is that as the angle of attack increases it does not readily adhere to the surface of the airfoil in the area of divergent flow above the wing upper surface between maximum camber and trailing edge. Having lost its inertia by the time it gets to the trailing edge, the suddenly increased pressure of the air aft of the wing becomes a barrier against which the particles pile up higher and higher, greatly thickening the boundary layer and leaving it an easy prey to the high pressure area aft of the wing which works its way forward in a wedge under the boundary layer. This results in what is known as "separation" or forceful detachment of the streamlines from their normal paths. This is shown by Fig. 3-B, and as you can see, finally results in a condition looking something like an undersized stall, even at quite low angles of attack. This state of affairs is greatly aggravated by an increase in the angle of attack, and as the average model wing glides at an attack angle of something like 5° to 8°, it is little wonder that the lift is lower and drag higher than what one might expect. This is another reason why your model loses lift at an attack angle far less than that at which the real airplane stalls—apart from the separation effect, the wing is already close to the stall in the normal glide and it does not take much to enlarge the already existing turbulent wedge.

TURBULENT BOUNDARY LAYER—Oversimplifying things again, it may require some changes of ideas to imagine that a boundary layer that is turbulent will actually cause the streamlines beyond the boundary layer to adhere to the airfoil contour when the laminar boundary layer will not. However, the explanation is not too difficult. Actually the air particles swirling around in the outer edge of the boundary layer mix to some degree into the adjacent streamlines which drag the outer boundary layer particles along a distance before they can get back down into the boundary layer. This means that the boundary layer actually has some more "push" added to it (absorbs energy) so that it can overcome the higher pressure area aft of the trailing edge. In this case the net result is that the higher pressure area is not able to work its way forward under the boundary layer, hence no separation with its ensuing loss of lift and increase of drag. With a turbulent boundary layer, Fig. 3-C, the lift stays up and the drag stays down.



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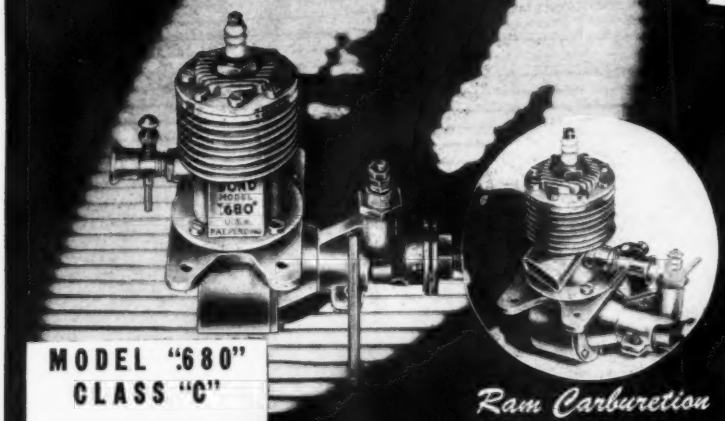
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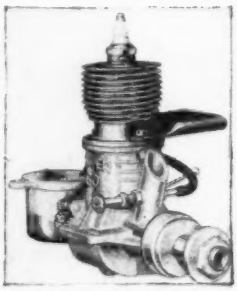
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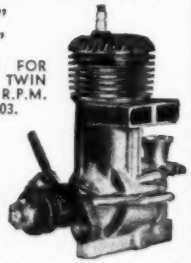
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Of course this condition cannot go on forever. There comes eventually, as the angle of attack increases, a pressure gradient between the air aft of the trailing edge and that over the wing which even the turbulent boundary layer with the help of the adjacent streamlines cannot surmount. The result of course is separation and the stall as an in Fig. 3-D—a real stall this time, but at a considerably higher angle of attack and much higher $C_{L\,max}$ than you could have obtained with the laminar boundary layer.

We have been a long time getting to the first point in this story. However, if you have not already suspected it, here it is: *the turbulent boundary layer.*

The obvious question now, of course, is: "How can I get a turbulent boundary layer with a wing that is far down in the sub-critical range of *R.N.'s*?"

Fortunately, the answer is not too difficult. You have several ways of accomplishing this; two of the easiest are:

1. Suitable selection of airfoil section.
2. Artificially producing a turbulent boundary layer on any given airfoil section.

Old Mother Nature has known about the effects of low *R.N.* for many thousands of years—and she has developed her wings and airfoil sections accordingly. When Otto Lilienthal began to construct his gliders in the late 1800's he turned to the natural prototype of the flying model—the bird. But he made his mistake in copying the wrong section and in not realizing the effects of *R.N.* It cost him his life, because while his airfoil was good at low *R.N.* it was quite unsuitable for the higher ranges in which he was gliding.

But now let us deal with the "suitable" airfoil section. First of all, there is ample evidence existing in scientific texts showing that a sharp leading edge promotes a turbulent boundary layer. Second, it can also be shown that a thin, well cambered section is definitely to be preferred at low *Reynolds Numbers.* If enough readers are interested, another "over-simplified" explanation can be given in another article.

Now perhaps you begin to see why such astounding flights are often made with indoor microfilm jobs even though they do not follow the big aircraft scheme of double surfaced, thick wings. It really is *because* of, not in spite of the airfoil. Of course the light wing loading helps—so do thermals (yes, you can catch plenty of them in a big hall)—but the main reason is of course our old friend—the turbulent boundary layer.

I mentioned before that Nature has known of such things ages ago. Ever watch a butterfly drifting along? Of course his light wing loading is a help, too, but so is his sharp leading edge. True, his airfoil section is nearer to a flat plate than a curved plate, but at his range of *R.N.* it is still lots better than the blunt nosed thick airfoil. He might perhaps get along a little better if he were to put a little camber in his wings, but then the curved plate is not as stable. A really excellent insect flyer with a heavier wing loading is the dragonfly. He has the thin leading edge all right but is not content with this and, like many other insects, forms his own turbulent boundary layer with a raised criss-cross pattern of veins over the entire wing aft of the leading edge which is not only thin but also serrated.

Birds have a different problem in much higher wing loadings and a sizable wing structure. But the best soarers certainly know how to make the most of it. Take the buzzard for example. He has a pretty thick spar but he still gives himself a

(*Turn to page* 78)

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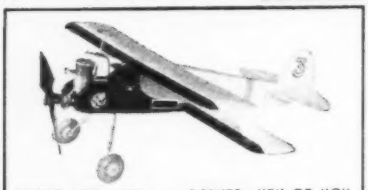
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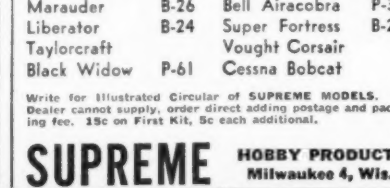
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moderately sharp leading edge by putting some of his wing muscles out in front and winds up with a section like that shown by Fig. 4-b. He does not seem to worry about the abrupt deepening of the section around his spar, and his feathers fair out the space aft of his wing bones into a well cambered, thin section. Another outstanding soarer, the eagle, has a similar section as shown by Fig. 4-a, but he fills in the section under the nose of his wing.

So now it looks as if the thin, cambered, sharp nosed section might be the one to shoot at, particularly for small, lightly loaded models flying at very low *Reynolds Numbers.* Other considerations come into the picture at higher sub-critical *R.N.* but we will talk about them in a later article.

Now we can touch briefly upon the possibilities of artificially producing a turbulent boundary layer. There is nothing particularly new and startling here. Prandtl knew how to do it as far back as 1904. It has been mentioned many times in scientific proceedings—and a few model airplane publications—since that time, but for some reason it never got into widespread use among airmodelers. It is simply a wire stretched the span of the wing about one-tenth the chord from the leading edge as in Fig. 5. Its commonly accepted name is the "Turbulence Wire." And it works on a thick, round nosed wing!

Now do not think the turbulence wire is the only solution. Prandtl was able to get substantially the same results with his experiments by using coarse sandpaper. So there is something else to try—a strip of coarse sandpaper, ground cork, or what have you, laid along the leading edge. Of course it will not look as nice as a slick, shiny wing—but it will probably work a whole lot better. Nature knows all about this too. She put numerous short, stiff hairs or even minute "sawteeth" along the front of the wings of many insects, including the dragonfly mentioned before.

When we first talked to MODEL AIRPLANE NEWS about this subject in the fall of last year, we had hoped to have conclusive test results to present along with this article. Unfortunately, circumstances would not permit carrying out adequate tests before winter set in and we were able to make only a hasty series of trials one evening last November.

Because it was easy to fit and adjust, we chose the turbulence wire rather than experiment with various grades of sandpaper or cork granules. The model was Marshal Green's latest effort, an improved 11-1/2 oz. version of his rubber powered Moffat ship. For the turbulence wire we used simply a piece of thin braided copper wire mounted on pins as you can see in the photograph.

In the one evening we had available we were able to make eight flights, alternate trips of which were made with the turbulence "wire" fitted. In calm air, the four flight average without the turbulence wire was 3 minutes 40 seconds. The four flight average with the turbulence wire was 4 min. 5 sec. The same number of motor turns were used for each flight. Although the difference was 25 sec. in favor of the turbulence wire, it is actually only about a 10% improvement, frankly not as much as we had hoped for, nor enough to be really conclusive evidence.* If more time had been available for adjustments, better flight times might have been made. By the time this is in print experiments will have started again and results will be duly reported.

Before closing, here is a brief note on the tapered wing planform. There is no question about the fact that the elliptical

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wing planform is ideal for the full size airplane, but for many reasons most manufacturers compromise on the straight tapered wing. But now consider the model. It is evident from the formula for *R.N.* that, speed and viscosity coefficient being unchanged, the *R.N.* varies with the chord. So if your model has a root chord of 8 in., a tip chord of 4 in., and the *Reynolds Number* at the root is 62,000, the tip *R.N.* will be 31,000. And as you may now have begun to surmise, different airfoil sections work better at different *R.N.* So until we know more about the subject, the rectangular wing, possibly with rounded tips, will probably work out best.

Unfortunately, few accurate wind tunnel tests have been made at low *R.N.*, the reason of course being that it has virtually no direct bearing on large aircraft. Now we find that the Germans, just prior to the outbreak of war, had been thinking seriously on the subject. The British too are becoming interested and are at the present time working in a group known as the "Low Speed Aerodynamics Research Association." Included in this group are some of England's better known aerodynamicists. So the outlook would appear promising for the modeller and we can expect many new developments in the near future.

REFERENCES.

1. *Airplane Design—Warner.*
2. *NACA Report No. 586—Jacobs & Sherman.*
3. *R.T.P. Translation issued by the British Ministry of Aircraft Production—Schmitz (Germany).*
4. *Simple Aerodynamics and the Airplane—Montieth and Carter.*
5. *Aircraft Engineering—Weyl (England).*
6. *T.R. No. 504 NACA.*
7. *Marks' Handbook.*

*Mr. Green's model had an Eiffel 431 profile which is, in effect, a thickened version of the simple curved plate known to have ideal characteristics at low R. If a more usual section, say NACA 6409, had been used, perhaps the results would have been more conclusive.—Editor.

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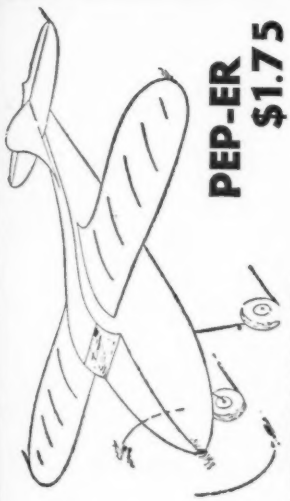
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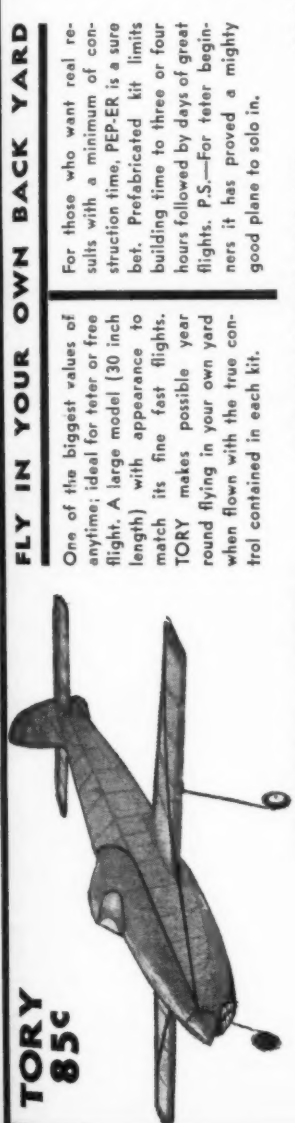
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Official Model Aircraft Regulations

Governing Sporting Model Aviation in America

Adopted by the Contest Board of THE ACADEMY OF MODEL AERONAUTICS

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I. Definitions

(A) MODEL AIRCRAFT. All aircraft of reduced size which are not capable of supporting a human being. Such aircraft are classified as indoor or outdoor models. No restrictions are placed on design of the models except that they shall meet the specifications listed in these regulations. The models must be so designed, however, that they drop no parts in flight or during take-off. Projected area of the horizontal stabilizing surface(s) in excess of 50 percent of the projected area of the supporting surface(s) (wing area) shall be considered as supporting surface for purposes of classification and wing loading requirements.

(B) INDOOR MODEL AIRCRAFT. A model of the indoor type is designed to fly indoors. Indoor models are classified as powered models or non-powered models. There are no weight specifications for such aircraft other than for flying scale models.

(C) OUTDOOR MODEL AIRCRAFT. A model of the outdoor type is designed primarily to fly outdoors. Outdoor models are classified as powered models or non-powered models. There are weight specifications for all outdoor aircraft. If ballast is used to bring an outdoor model up to the required weight, such ballast shall be permanently affixed to the model.

(D) STICK MODEL. A model of the stick type has a body composed of stick(s), tube(s), or open framework, rather than a fuselage. Models using tubes or framework to enclose the motor(s) shall have a total maximum cross-section area of the tubes or sticks not greater than $L^2/150$, where "L" equals the overall length of the model, excluding the propeller(s). A model powered by other than an internal combustion engine of the "flying wing" category shall be included for purposes of competition in the stick model classification. A "flying wing" has no fuselage, nor has it stabilizing surfaces other than those fastened directly to the single supporting surface.

(E) CABIN MODEL, POWERED BY OTHER THAN INTERNAL COMBUSTION ENGINE(S). A model of the cabin type powered by other than internal combustion engine(s) has built-up enclosed fuselage. The total maximum cross-section area of the fuselage(s) must not be less than $L^2/100$, where "L" equals the over-all length of the model, excluding the propeller(s). In the case of multiple fuselages, the sum of their cross-sections shall be considered. The fuselage(s) shall have not less than 90 percent of its (their) surface area covered. Outriggers and booms may be used. The rubber used for motive power shall be contained entirely within the built-up fuselage.

(F) MODEL AIRCRAFT POWERED BY INTERNAL COMBUSTION ENGINE(S), FREE-FLIGHT. Model aircraft powered by internal combustion engine(s) shall have a built-up fuselage of the cabin type. The maximum cross-section area of the fuselage(s) must not be less than $L^2/100$, where "L" equals the over-all length of the model, excluding the propeller(s). The fuselage(s) shall have not less than 90 percent of its (their) surface area covered. There shall be no fuselage cross-section requirements for model aircraft of the "flying wing" category. A "flying wing" has no fuselage, nor has it any stabilizing surfaces other than those fastened directly to the single supporting surface.

(G) CABIN MODEL, NON-POWERED. A non-powered model of the cabin type (towline glider) must have a total maximum cross-section area of the fuselage(s) of not less than $L^2/100$, where "L" equals the over-all length of the model. The fuselage(s) shall be of streamline form and have not less than 90 percent of its surface area covered. Outriggers and booms may be used. There shall be no fuselage or stick cross-section requirement for towline gliders of the "flying wing" category.

(H) HAND-LAUNCHED. A model airplane is hand-launched when it is released into flight directly from the hands of the launcher. The model shall be launched from an elevation of not more than 6 feet above the ground or floor.

(I) RISE-OFF-GROUND. A model airplane of the rise-off-ground (R.O.G.) type has a take-off gear that permits it to take off from the ground, floor, or runway under its own power. R.O.G. models may be guided, but not pushed nor mechanically assisted, by the contestant. In guiding a model at the start of its take-off run, the contestant shall not take a forward step. Mechanical take-off assistance is not permitted. The take-off gear must be strong enough to support the model in a normal attitude while at rest and permit it to take off without damage, nosing over, or striking a wing tip. When one wheel is used, skids or similar devices shall be required to keep the model upright in a normal attitude and to prevent any part other than the take-off gear from touching the ground, floor or runway. Wheel(s) shall turn

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freely and be of such strength and size as to permit the model to taxi freely. The minimum diameter of the wheel(s) for all models powered by other than internal combustion engine(s) is as follows:

One-half inch, where the projected area of the supporting surface(s) does not exceed 30 square inches; three-quarters inch, where the projected area of the supporting surface(s) exceeds 30 but it is not more than 100 square inches; one inch, where the projected area of the supporting surface(s) exceeds 100 but is not more than 150 square inches; one and one-half inches, where the projected area of the supporting surface(s) exceeds 150 but is not more than 300 square inches; and two inches, where the projected area of the supporting surface(s) exceeds 300 square inches.

(J) LAUNCHING. A model powered by internal combustion engine(s) or powered by other than internal combustion engine (s) must R.O.G., except in the case of R.O.W. models and except in the event of extremely adverse weather conditions, when, at the discretion of the Contest Director, models may be hand-launched. No records shall be recognized if made by hand-launched models.

(K) TOWLINE-LAUNCHED. A model airplane is towline-launched when it is pulled into the air from the ground by an inextensible line. The towline shall be no longer than 100 feet, and shall be released from the model by the launcher at the end of the tow. Launching mechanism designed to assist the take-off may be used provided it is dropped from the glider at the same time the towline is released. To assist in determining the time of release, a fabric or paper streamer shall be affixed to the towline not more than 12 inches from the end which is attached to the model.

(L) RISE-OFF-WATER. A model airplane of the rise-off-water (R.O.W.) type can take off from and alight on water and shall float unassisted. All surfaces and parts other than floats or pontoons shall be above the surface of the water. The model shall take off from the water starting from a standstill under its own power, but it is not required to land on the water at the end of the flight. Indoor rise-off-water models shall demonstrate their seaworthiness by floating unassisted five seconds. Outdoor rise-off-water models shall demonstrate their seaworthiness by floating unassisted thirty seconds.

(M) MODELS POWERED BY INTERNAL COMBUSTION ENGINE(S). NOT FREE-FLIGHT. A model airplane of the control type is designed to fly under control of the operator by means of cord(s), string(s), or wire(s) attached to the model in such a way as to provide means for controlling the flight of the model. Control models shall have take-off gear which permits them to take off and land in a normal fashion, as described under RULE I (I) except that device(s) for retracing and lowering the landing gear may be used.

(N) AUTOGIRO. An autogiro model is supported in flight by the action of the air on vanes which rotate freely on an approximately vertical axis, supplemented by the thrust of propeller(s) on an approximately horizontal axis. If a fixed wing is employed, the projected area of the vanes shall not be less than that of the fixed wing(s), and the sums of these projected areas shall be considered the main supporting surface(s).

(O) ORNITHOPTER. An ornithopter model derives its propulsion solely from the flapping of its wing(s). The projected area of the wing(s) shall be taken midway between the upward and downward positions of the wing(s).

(P) HELICOPTER. A helicopter model rises without assistance and is supported in flight solely by the lift of power-driven propeller(s) and/or vane(s). The projected area of the propeller(s) and vane(s) shall be considered the supporting surface(s).

(Q) GLIDER. A glider is similar to a model airplane but differs in that it has no power plant.

II. Classification

(A) MODEL AIRCRAFT POWERED BY INTERNAL COMBUSTION ENGINE(S). Both free-flight and controlled-flight models powered by internal combustion engine(s) are classified by engine(s) displacement as follows:

Class A, where the displacement of the engine(s) does not exceed .20 cubic inches; Class B, where the displacement of the engine(s) exceeds .20 but is not more than .30 cubic inches; and Class C, where the displacement of the engine(s) exceeds .30 but is not more than 1.25 cubic inches. Free-flight models powered by internal combustion engine(s) shall employ a device to limit the length of the engine run and may utilize a device to limit the length of the flight time.

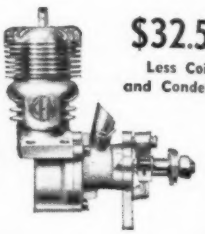
(B) MODELS POWERED BY RUBBER, SPRING, OR HAND-LAUNCHED. All models other than those powered by internal combustion engine(s) are classified by projected area of the supporting surface(s) as follows:

Class A, where the projected area of the supporting surface(s) does not exceed 30 square inches; Class B, where the projected area of the supporting surface(s) exceeds 30 but is not more than 100 square inches; Class C, where the projected area of the supporting surface(s) exceeds 100 but is not more than 150 square inches; Class D where the projected area of the supporting surface(s) exceeds 150 but is not more than 300 square inches; and Class E, where the projected area of the supporting surface(s) exceeds 300 square inches.

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(C) MODELS POWERED BY OTHER THAN RUBBER OR INTERNAL COMBUSTION ENGINE(S). (EXPERIMENTAL). These models with experimental miniature engines (excluding rockets) shall follow the same categories as internal combustion powered models in respect to classes and piston displacement. Complete specifications shall be submitted to the Academy of Model Aeronautics with each record claim in this category.

III. Wing Loading Requirements

(A) INDOOR. There are no wing loading (weight) requirements for indoor model aircraft.

(B) OUTDOOR MODEL AIRCRAFT POWERED BY INTERNAL COMBUSTION ENGINE(S). All free-flight model aircraft powered by internal combustion engine(s) shall be limited to a total flying weight of not more than 7 pounds, shall weigh not less than 80 ounces for each cubic inch of engine(s) displacement, and shall weigh not less than 7 ounces for each 100 square inches of projected supporting surface(s).

(C) MODELS POWERED BY INTERNAL COMBUSTION ENGINE(S). NOT FREE-FLIGHT. Model aircraft of the control category in which the operator controls the flight of the model by means of cord(s), string(s), wire(s), attached to the model, shall weigh not more than 3 pounds for each square foot of projected lifting surface(s) area and not less than 80 ounces for each cubic inch of motor displacement. Control models shall meet the following minimum wing area requirements:

Class A—Not less than 75 square inches; Class B—Not less than 125 square inches; and Class C —Not less than 200 square inches.

(D) MODELS POWERED BY OTHER THAN RUBBER OR INTERNAL COMBUSTION ENGINE(S). (EXPERIMENTAL). Model aircraft of this category shall follow the wing-loading and piston-displacement classifications outlined for free-flight model aircraft powered by internal combustion engine(s).

(E) OUTDOOR MODEL AIRCRAFT POWERED BY OTHER THAN INTERNAL COMBUSTION ENGINE(S). All outdoor model aircraft powered by other than internal combustion engine(s) shall weigh, complete and ready to fly, not less than 3 ounces avoirdupois for each 100 square inches of projected supporting surface(s), except autogiros, ornithopters, and helicopters.

(F) OUTDOOR AUTOGIROS, ORNITHOPTERS, AND HELICOPTERS POWERED BY OTHER THAN INTERNAL COMBUSTION ENGINE(S)—shall weigh, complete and ready to fly, not less than one ounce avoirdupois.

(G) OUTDOOR MODEL AIRCRAFT, NON-POWERED. Outdoor hand-launched gliders shall weigh, complete and ready to fly, not less than 2 ounces avoirdupois for each 100 square inches of projected supporting surface(s). Outdoor towline-launched gliders shall weigh, complete and ready to fly, not less than 3 ounces avoirdupois for each 100 square inches of projected supporting surface(s). Launching aids or stabilizing devices used in launching, and which are designed to be dropped at release, shall not be considered as an integral part of the model when checking for wing-loading requirements.

IV. Categories

The Academy of Model Aeronautics has established the following model aircraft categories:

(A) INDOOR MODEL AIRCRAFT, POWERED—
Stick Models, Hand-Launched ..... Class B, C
Stick Models, Rise-Off-Ground ..... Class A, B
Stick Models, Rise-Off-Water ..... Class A, B
Cabin Models, Rise-Off-Ground ..... Class B, C
Cabin Models, Rise-Off-Water ..... Class B, C
Autogiro, Launching Optional ... No classes for size
Ornithopter, Launching Optional . No classes for size
Helicopter, Launching Optional .. No classes for size

(B) INDOOR MODEL AIRCRAFT, NON-POWERED—
Glider, Hand-Launched ..... Class A, B

(C) OUTDOOR MODEL AIRCRAFT, POWERED BY INTERNAL COMBUSTION ENGINE(S)—
Cabin Model, Rise-Off-Ground ..... Class A, B, C
Cabin Model, Rise-Off-Water ..... Class A, B, C
Control Model, Rise-Off-Ground ..... Class A, B, C (Speed only)
Control Model, Rise-Off-Water ..... Class A, B, C (Speed only)
Experimental Model ..... Class A, B, C

(D) OUTDOOR MODEL AIRCRAFT, POWERED BY OTHER THAN INTERNAL COMBUSTION ENGINE(S)—J
Stick Model, Hand-Launched ..... Class C, D
Stick Model, Rise-Off-Water ..... Class C, D
Cabin Model, Rise-Off-Ground ..... Class C, D, E
Cabin Model, Rise-Off-Water ..... Class C, D
Ornithopter, Launching Optional ..... No classes for size
Helicopter, Launching Optional ..... No classes for size

(E) OUTDOOR MODEL AIRCRAFT, NON-POWERED—
Glider, Hand-Launched ..... Class B, C, D
Cabin Glider, Towline-Launched ... Class C, D, E

(To be concluded in the next issue)

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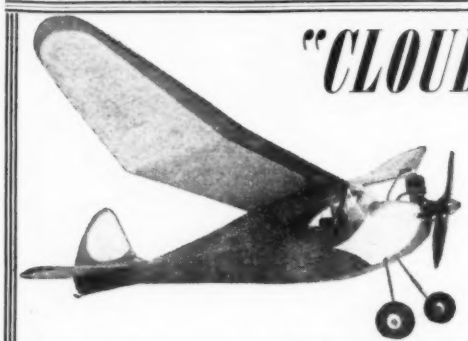
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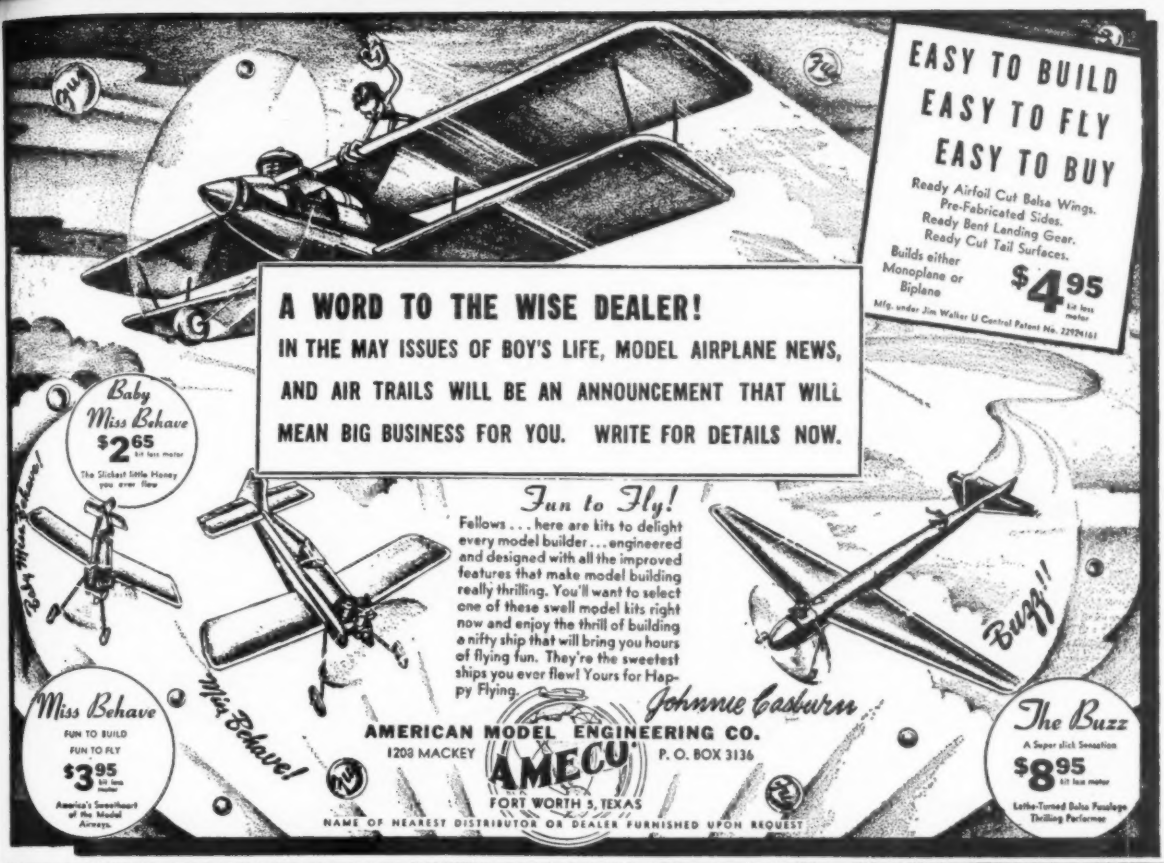
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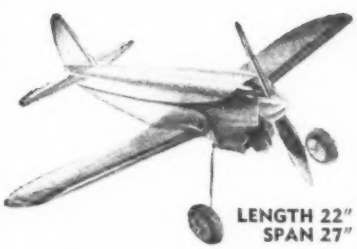


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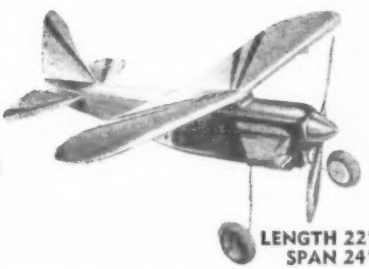
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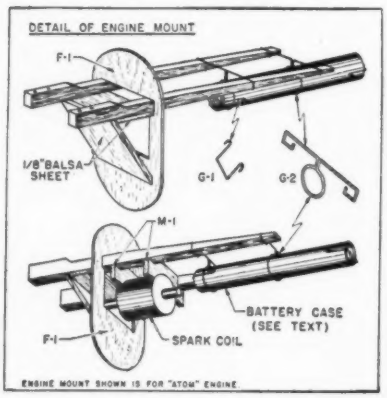
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Tornado

(Continued from page 31)

over the ribs. Now, using a template, cut 11 stabilizer ribs to the curve shown on the full size stabilizer rib outline. These are cemented in place to form the top of each rib. In working out from the center towards the tips, the ribs must be shortened. The trailing edge end of the strip should be trimmed to obtain the desired length. The rudder is fairly similar to the stabilizer in construction, with the exception that the 1/8 in. sheet parts are built flat on the workbench, and when the cement has dried the 3/32 in. sq. ribs are cemented in place to obtain a rudder of symmetrical crossection.

ENGINE MOUNT — Following the shape given on the 1/4 in. squared-off drawing, cut two engine bearers from 1/4 in. hardwood. Providing an *Atom* engine is used, cut F-1 out as shown. Slip in place and cement 1/8 in. sheet balsa braces in place so that F-1 is perpendicular to bottom edge of the engine bearers.



The landing gear should be cemented in place now before much of the cowling is made. In any event, make sure the struts are slanted well forward to provide maximum propeller protection. If the wheels are not located far enough forward it will be found that the small wheels will snag when landing in grass causing the model to flip over on its back. In this respect a pair of airwheels will be effective as they will keep the model right side up when a landing occurs in softy sandy areas or in grass. Thin wheels are better for streamlining, it is true, but they have a bad tendency to "dig in" on some landings, causing the inevitable "nose-over." Two braces (M-1) are used to cement the spark coil in place. Silk thread is wound around the coil and mount—cement being added for extra strength. The battery case can be of any type but a simple and strong affair can be assembled in jig time by wrapping heavy paper around two pencils until three or four layers have been cemented together to obtain a rigid tube. A tube of this sort is light and strong and a slot in each end will keep the connections (G-1) from slipping off. A rubberband on each side of the tube will provide the necessary tension to make good electrical contact between G-1 and the battery terminals. Two wire supports (G-2) keep the battery case in place and if this tubular type case is employed it will be possible to shift it in making flight adjustments before it is cemented in place.

The landing gear can be bent to shape and cemented in place now. A cowl will help appearance considerably and will

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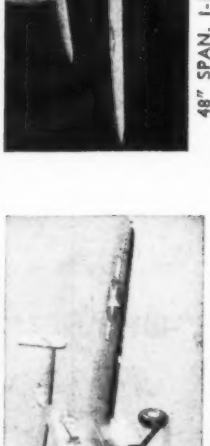


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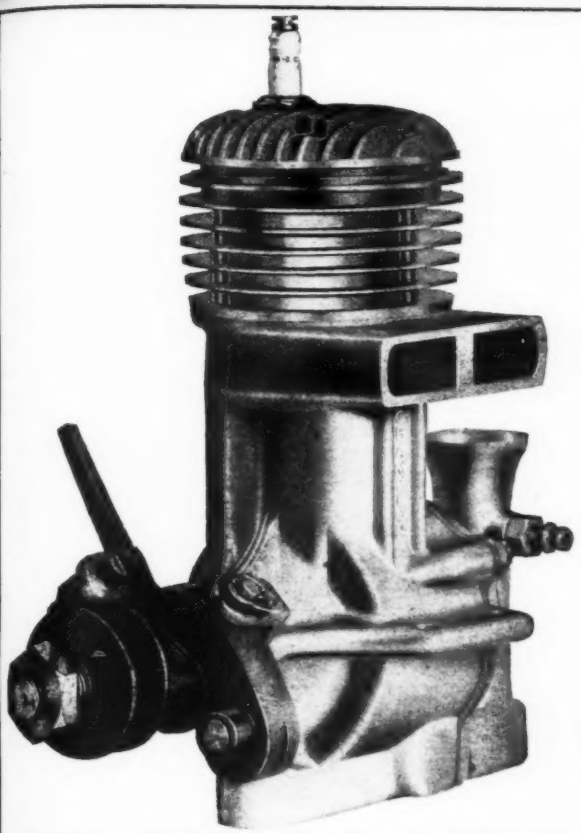
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WING—The wing employs a built-up rib for lightness but it will be noted that the spacing is 1 in.—this close spacing helps in obtaining a good airfoil. The outline of each wing panel is laid down now. Once the leading edge, trailing edge and tips have been pinned down to the workbench according to dimensions on the plans, the bottom of each rib can be cemented in place. The spar is tapered to shape next and cemented in place. After cutting out 31 ribs (or rib capstrips as they should be called) from 3/32 in. sheet they are cemented in place at the point of widest chord. Smaller ribs toward the tips are obtained by trimming the rear end of the cup strip until it fits in place.

FLIGHT ADJUSTMENTS — Adjustments on the original model were made to obtain a large circle to the right. Both under power and in the glide. Hand launched test glides were made until it could be determined that the glide was as smooth and as flat as possible with a tendency to edge over to the right *without* excessive banking. Once satisfied

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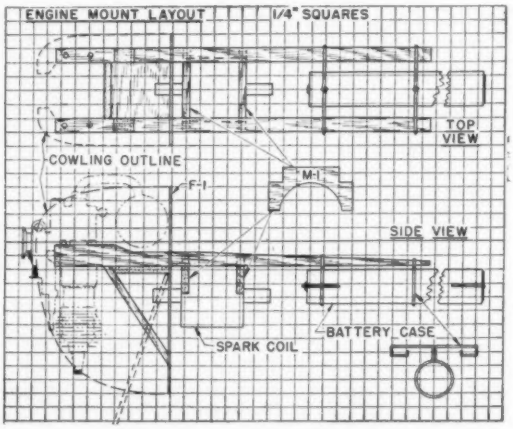
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with the glide, short powered flights should be attempted. And *don't* rev up that engine at this stage of the game unless you're looking for a spectacular end to all your labors. The powered portion of each flight should be watched now and the engine should be offset to obtain a gradual, even climb to the right. A large circle is the best thing for the powered flight of a small gas model because a tight circle in *either* direction is the next thing to a spiral dive, which "ain't good."



Spend time on flying adjustments, always a little at a time, and you'll be able to bring home a model all in one piece—or a reasonable facsimile thereof."

Miss Bobby Sox

(*Continued from page* 17)

erly speaking, the *'Lark III* was *Miss Bobby Sox I,* but it was really designed as a towliner, not a rubber job.

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has been proven by the *Sox'* forerunners. In most models the turtledeck, added for streamlining, is not designed for carrying load. By using good hefty stock for the keels, and cementing them securely to the primary box frame to transmit the load, the keel will carry approximately 20% of total load the rubber motor imposes on the frame. We took a tip from the Grumman *Tigercat's* construction. In this ship the main longitudinal member is an extruded channel-section keel along the top of the fuselage, hence the 1/16 in. x 1/4 in. keel, which is the *Sox'* backbone. Since the *Sox'* thrust line is rather high, the lower keel does not contribute appreciably to relieving stress in the frame and was added primarily for streamlining. Now that you have the theory behind the type of construction used, let's get on with the building.

The primary frame is made of 3/32 in. sq. rock-hard balsa; select the longerons carefully. From the cabin on back truss-type construction is used. While this gives greater strength, it also allows the tissue to distort the longerons slightly when it tightens. This could be remedied by having the stations closer together, say a 3 in. spacing of joints instead of 4 in. spacing used.

Cement the two sides together at rear and work forward as you add the crossbraces. Note that the crossbraces are spaced every 2 in. aft of the cabin. Cement the formers in position and add the keels. Add the 1/16 in. sq. cabin stringers and 3/32 in. sq. nose stringers. Cement the wing mount in place. Make sure the dowel is secure. Cement the nose block in place and sand to shape. Cut out a 3/4 in. sq. section for changing the motor. Fill in the rear of the fuselage with 3/32 in. sheet for anchoring the 3/16 in. dowel motor plug. Cement the retractable gear in position.

Before covering the frame "scallop" all formers so they will not touch the covering. Then sand the entire frame lightly to remove any flaws or roughness which would mar the smoothness of the covering job. Silkspan is the covering material. Use the heavy gas model grade on the bottom. Cover as large a section as possible without getting wrinkles. Don't worry about pulling the tissue tight, just make sure it's wrinkle-free; dope will tighten it. Cement the celluloid windshield in place and the fuselage is finished. If desired make provision for a dethermalizer. Five coats of clear dope are brushed on.

LANDING GEAR—This is the usual monowheel type actuated by the position of the plane. When the plane is tilted upward at an angle of more than 30° the gear will snap up. Landings are made with the wheel in the retracted position. Generally speaking, any type of extended landing gear is useless for rubber jobs, since the small diameter wheels usually snag and throw the ship over. "Takeoff" gear would be more appropriate since it is used for this purpose.

The wheel is of laminated balsa for lightness. All parts are shown half size on the plans. Bend up the leg from .047 in. wire making all bends sharp. Add the wheel and solder on a washer to retain it. Split the hinge block down the center and reglue in place around the wire. Cement it and the front hook in place in the fuselage and connect the two with a suitable rubberband. Adjust until the leg snaps up when the fuselage is tilted up 30°. Add a 1/4 in. sq. stop to limit forward travel of the leg. Brace the whole hinge block with gussets, covering all with a generous coating of cement.



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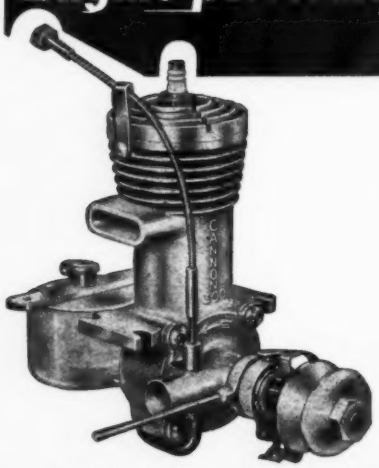
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PROPELLER — The prop being the thing that pulls your ship up there, it's a good idea to do a first rate job on it.

Both one and two blade folding props were tried. We found that the two blade prop gave a faster climb, which does not necessarily mean the type is better. However, while it was a simple matter to balance a one blade prop statically, it was quite another thing to balance it dynamically. It did not function as smoothly as the two blade and this cut down the thrust it delivered.

The prop itself? It's quickly carved from a medium hard balsa block. Blank out the block, drill the prop shaft hole, and rough out the two inside faces. Carve 3/16 in. undercamber into each face. Carve the front or convex surfaces last. Do not carve away any part of the hub. Remove any ridges or high spots and sand to an airfoil section. Fit the template against the concave surface of the blade and trim to shape. The blades should be at least 1/8 in. thick at point of maximum camber.

Cement the hinges in place and cover the prop with Silkspan before cutting the blades at the hub. Tissuing the prop gives both strength and a smooth surface. Cement the spinner over the hub.

Bend the rubber hook in the prop shaft, slip on the nose block, washers, spring and prop and finish bending up the shaft. Cement it securely in the spinner. You now have a unit that will really grab altitude for your job.

WING—Wing construction is orthodox and should give the builder no trouble. All ribs are 1/16 in. sheet balsa. If hardwood is used cut lightening holes. Ribs and other sheet members should be cut out before starting construction.

Build outline of the wing first, that is, the leading and trailing edges and tips. Cement each rib in place carefully and the 1/16 in. sq. upper spar.

The 3/16 in. sq. main spar is built up separately, the dihedral angles being cut accurately and gussets cemented in place. Leading and trailing edges and 1/16 in. sq. spar of the wing are then cracked and the main spar cemented in place. Since the main spar is built directly on the plan, correct dihedral is insured.

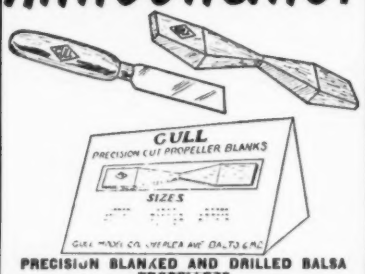
Cover the section from leading edge back to the 1/16 in. sq. spar with 1/32 in. sheet balsa. This is done by cementing the edge of the balsa sheet to leading edge of the wing first, then when the cement has dried, each rib and the spar are coated with cement and the sheet curved back and pinned in place until the structure has dried. Reinforce the trailing edge in center of the wing with celluloid to prevent the rubber wing bands from crushing it. Sand the entire structure lightly preparatory to covering it.

Silkspan is the covering material, thick dope the adhesive. The Silkspan is applied wet. When covering the upper surface of the wing, dope the tissue only to the root rib, the leading and trailing edges, and the tips or dihedral rib depending on the section being covered. This permits the tissue to tighten evenly over the entire surface of the wing as it dries. Since a flat bottom airfoil is used the lower surface of the wing may be covered in the same way. When covering undercambered wings it is necessary to dope the tissue to each rib to preserve the wing section. The wings should be given four or five coats of clear dope. Dope only one panel at a time and pin or weight down the leading and trailing edges to prevent the wing from warping. Incidentally, a few good heavy volumes

(*Turn to page* 92)


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3/32x3/8	2 " 6c		
1/8x1/8	3 " 5c		
1/8x1/4	2 " 7c		
1/8x3/8	2 " 6c		
3/16x3/16	3 " 6c		
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3/16x3/8	2 " 6c		
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come in handy for weighting down the edges. Matched books, such as encyclopedias, are useful in raising wing panels to the right height when putting dihedral in a wing. (Protect the books from dope or glue stains with waxed paper, though.)

EMPENNAGE—Stabilizer and rudder construction is unusual only in that the control surfaces are movable. Note that both have streamline sections.

Material used in construction is noted on the plans. Build both stabilizer and rudder directly on the plan. Ribs of both are 1/16 in. x 1/4 in. stock trimmed and sanded to shape after assembly. The elevator and horizontal fin and the rudder and vertical fin are built separately. Aluminum strips 1/8 in. x 1/2 in. serve as hinges. Another type hinge which works very freely and which we developed for control line models is also shown. However, it is necessary to use an adjustment with this type hinge when it is used on free flight jobs.

Sand the structures lightly and cover with Silkspan just as was the wing. Give both stabilizer and rudder four or five coats of clear dope.

Cement stabilizer to the fuselage and when the joint has dried the vertical fin is added. Make sure these surfaces are at right angles to one another (when viewed head on), testing with a draftsman's triangle. Put a cement fillet all along the joint, both for strength and streamlining. It is incidentally a good idea to put a fillet of cement at all joints, and is imperative if hardwood has been substituted for balsa. Cement the sub-rudders in place as shown; these serve as twin tail skids.

FLYING—Check balance of the model first by balancing it on your fingertips under the wing. It should balance at the 30% point of the chord. Glide the model into the wind; if the ship stalls bend elevators down slightly—if it dives bend them up. Variations in wind velocity have a corresponding effect on adjustment of the model. Prewind the rubber before inserting it into the fuselage. Use a winder and stretch the motor out to 4-1/2 times its length, moving in as the winding progresses. Use about 100 turns on preliminary flights. Both climb and glide should be to the right. Adjust thrust line until climb is in this direction. Gradually increase number of turns as the testing proceeds. The glide should be fast and flat. If the glide is too slow the airfoil loses its efficiency.

When she's climbing and gliding right, pack in the turns. Ten strands of 1/4 in. x 1/30 in. brown rubber will take 700 turns easily for sport flying. For all-out effort in a contest make it 14 strands and wind in 650 turns. These figures are maximum safe number of turns for rubber. Fuselage will take about 1200 if rubber will do it. Our 14 strands snapped at 800 turns, retied went to 1000, let go again.

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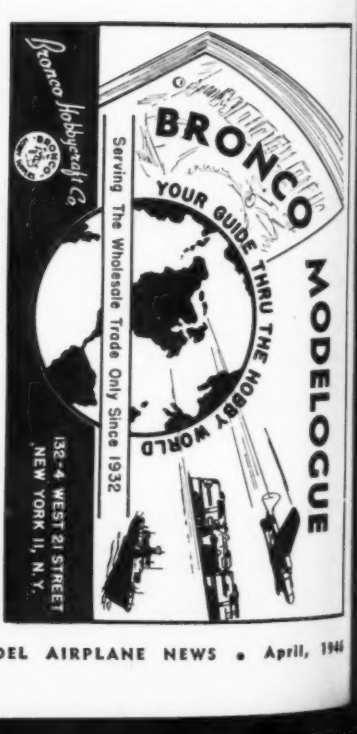
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Plane on the Cover

(*Continued from page 15*)

cance, can be wasted. For maximum range everything counts!

How to attack this paradox? The obvious first thought is to overload the airplane, put in the bombs then pump as much gasoline in as the pilot thinks he can take and yet get off the ground! Yes, it worked, hundreds of thousands of times. Bombers designed for 120,000 lbs. gross weight carried 160,000 lbs.! Cargo planes never meant to carry more than 2 tons carried 5 tons! Sure, it can be done and was done over and over again when the primary problem was getting a heavy load off the ground. But such operation failed miserably on the long range score: it just doesn't work.

Why not? Here are some of the reasons: Each time the loaded weight of the airplane is increased 1% the hp required to lift it must be increased 1-1/2%! Obviously, this is a law of diminishing returns. It can be worked, and worked successfully, up to the maximum hp of the engines and that's the limit. Beyond that the simple solution of loading in more cargo, fuel or bombs cannot go!

For example, let's take the rugged, dependable Douglas C-47 *Skytrain* (and no plane was more aptly named!) Suppose you want to add 500 gallons of gasoline in order to fly it farther. That extra 3000 lb. load would require just 420 more hp! And where do you intend to get it? The answer is: you can't without putting in new and more powerful engines. And with the planes and their engines in mass production, and the two coming to you from America in great quantities, your request for more powerful engines would thoroughly foul up the whole works.

But suppose you placed that extra 3000 lbs. in a glider? The answer to that poser is supplied by the hundreds of thousands of successful glider tows in every theater, with every cargo under all conceivable conditions. It works remarkably well!

It is only fair to ask: why can you carry that 3000 lbs. in a glider when you can't carry it in the airplane? Let's examine the famed Waco CG-4A all-purpose glider. During the war a special experimental version was test powered by two Franklin aircooled engines developing 130 hp each, or 260 hp total. This power lifted and flew the regular 3000 lb. load of the glider version. Obviously, then, 260 hp is required to fly a CG-4A. This power is also required to add 1900 lbs. to the useful load of a Douglas C-47. Therefore, if we were to remove 1900 lbs. from the C-47 and add on a CG-4A carrying 3000 lbs. of load, the result would be approximately the same! In other words, by glider tow we can lift 2100 lbs. and fly it to our destination figuratively free of charge. And that's just what was accomplished during the war.

That was excellent for the cargo planes and their slow-flying speeds. But it was obvious that a CG-4A, whose towing speed is 125 mph. could never be towed by a B-29 *Superfortress* on a bombing mission. Yet that was exactly what engineers at Wright Field wanted to do: build a "flying gas tank" glider to be towed by our bombers on long range missions and to feed additional fuel to them as required. But this could be no ordinary glider. It had to be capable of a 250 mph towing speed, strong enough to withstand the shock of high speed takeoffs and yet slow-landing enough to return to war built airfields safely.

This idea was crystallized into a specification and Maj. F. J. Sweet and Capt.

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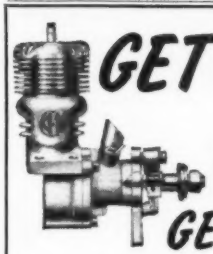
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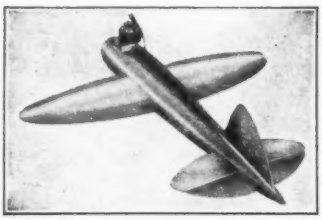
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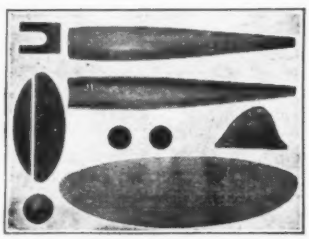
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A. J. Stolzenberger, of the ATSC at Wright Field, were assigned the project. This was in the fall of 1943, the same time that another idea was being developed in another section of the Command.

A proposal for a new type of aircraft layout and design had been submitted by Cornelius Aircraft Corp. of Dayton, Ohio. Although the exact details of this proposal, or the type of airplane it represented cannot yet be told, when Maj. Sweet and Capt. Stolzenberger examined it they saw the spark of an idea and the possibilities of adapting this new type of design to their immediate problem—a fuel carrying, high speed glider.

George Cornelius was asked if he could do the job and the two engineer officers received his enthusiastic assurance. Cornelius was no newcomer to the aviation field; as early as the middle twenties he had begun experiments on the "variable incidence" problem that had tempted engineers for years. The merits of such a design are that the airplane rides level, whether climbing or diving, the wing chord rotating at the response of the pilot to vary the attitude of the airplane in the pitching plane. By 1933 he had completed his "Fre-wing" and made countless successful flights from his Long Beach, Calif. "shop." Variations on the idea continued through the thirties while Cornelius embraced the idea of a forward-swept wing. The use of this planform lent itself admirably to the "tailless" type aircraft and he pursued the idea vigorously. His experiments led to the proposal submitted to the ATSC and the suggestion of the glider application.

Cornelius and his engineers immediately began modifying the design into a flying gas tank glider in his Dayton plant. Because of this location it was possible to confer constantly with ATSC engineers who worked closely with Cornelius on the control system of the design. Having no horizontal stabilizer or elevator, longitudinal controls are contained in the inboard trailing edge of the sharply swept forward wing. The fin and rudder are exceptionally large, to provide the directional control lacking in the tailless design, and are located at the apex of the "V" wing. Following satisfactory design solution of the control system problem, Cornelius was awarded a contract for two complete gliders plus one static test model. He obtained a large automobile garage and repair building in downtown Dayton and began construction of the strange war weapon, designated XFG-1 for Experimental Fueling Glider, by the ATSC.

The first XFG-1 was completed in September 1944 and delivered to the Clinton County Army Air Field, near Dayton, for flight tests. These proved so successful that a contract for its manufacture in quantity was awarded to Spartan Aircraft Corp. in Tulsa, Okla. During one of the tests, however, the first XFG-1 went into a spin and was demolished in a crash. The second glider was completed, however, as well as the static test model.

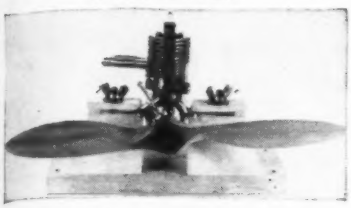
The XFG-1 has a wingspan of 53 ft. is 28 ft. 8 in. long and stands 14 ft. 6 in. high. Of composite wood and metal construction, it might be termed a high wing monoplane. The wing root actually is at the tail of the fuselage but, due to the sweep forward of the panels, the mean aerodynamic chord is in the conventional longitudinal location. The pilot is enclosed in a bubble canopy and the landing gear is of the tricycle type. The fuel tank is of welded aluminum alloy and comprises the fuselage structure as well. The

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nose and tail, of welded steel tubing, are bolted fore and aft of the tank. Wooden stringers provide forms on which fabric covering is laced. The wings are of combination construction with laminated wood covering. Conventional ailerons are carried but the inboard trailing edge surfaces act both as landing flaps and elevators. Heavy metal skids are provided on the bottom of the tank portion of the fuselage.

Tests continued from October 1944 through September 1945, the end of the war signalling the end of development of the XFG-1. The Spartan contract was cancelled before any of the gliders were actually in production. The second, and only, XFG-1 is now at Wright Field. A special project was the development and test of a radio controlled model of the type, but the ATSC cannot release any details on this particular phase of the program other than confirmation of its existence, indicating that further development is still in prospect.

Thus ends another of the countless new ideas and developments tossed up by the whirlpool of war and eagerly grasped and tested by the Army Air Forces and Naval Aviation in the hope that here, perhaps, was another effective weapon to toss into battle against our enemies.

But the armed services search doesn't end here. Regarding the XFG-1 flying gas tank glider, the ATSC says: "It has been successful insofar as information derived from its construction and tests will be of future benefit to Army Air Forces design."



1946 officers for Model Industry Ass'n.: (l. to r.) Harold Auler, Treas.; Franklin Butler, Sec'y; E. B. Miller, Pres.; R. W. Mair, Vice-Pres.

Upon returning from the Trade Show and Convention, Chicago, January 23-26, Jay P. Cleveland, General Manager of MODEL AIRPLANE NEWS, was convinced of a rising tide of enthusiasm among the increasing number of modelers and entire Model Industry.

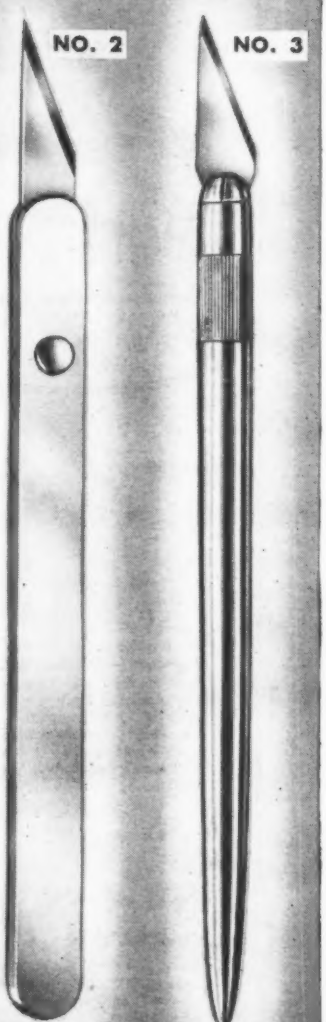
The Convention, first since the beginning of the war, far eclipsed all its predecessors in attendance, spirit, and number of exhibits. Features of the show occasioning considerable surprise to visitors were those tangible proofs that the Model Industry was keeping abreast of today's scientific advances—they included displays of jet propulsion planes, tiny solid models, radio controlled model aircraft, etc.

Representative Jennings Randolph (D., W. Va.), a well-known figure throughout aviation circles, in an address to the Association stated that the growth of the model industry over the last ten years was the growth of American boyhood, that as a hobby craft which taught by *doing* he expected the industry, within five years, would easily reach a volume of $100,000,000!

Among the postwar plans of the Association reported at the Convention were: the distribution of education film material to schools and recreational groups; utilization of model building in all veterans' hospitals (the Veteran's Administration recognizes the therapeutic value of such a program); and a proposal to classify model kits with regard to constructional difficulties, to establish a set of standards to correlate the kits to industrial art, veterans and recreational and educational procedures.

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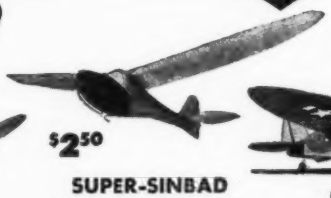


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